ne April 2, 1956

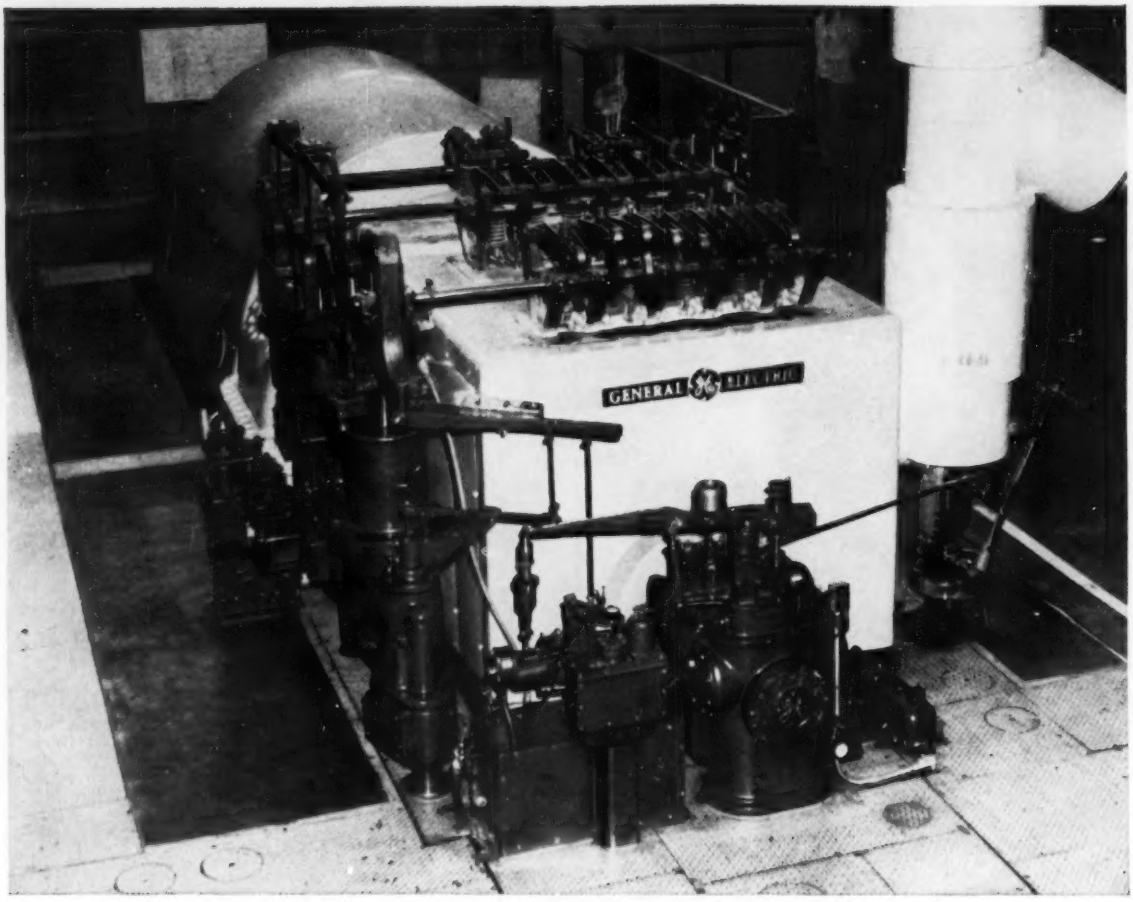
cal World

A McGraw-Hill Publication

A Special Report:

THE HEAT STORM

ROUND



"16 Years of Trouble-Free Turbine Performance"

THIS paper mill (name on request) first became a Texaco user in 1939, when they put two 6,000 kw. G-E turbines on the line. Results in terms of clean, efficient performance were so satisfactory that *Texaco Regal Oil R&O* was the logical choice to lubricate two new 10,000 kw. turbines added in 1947 and 1948. The latest report from the mill's power plant superintendent states:

"Texaco has given us 16 years of trouble-free turbine performance. We find that *Texaco Regal Oil R&O* keeps our turbine systems free from sludge, rust and foam...assures normal bearing temperatures and instant governor response."

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TEXACO Regal Oils R&O

FOR ALL TURBINES

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Electrical World

Published for 82 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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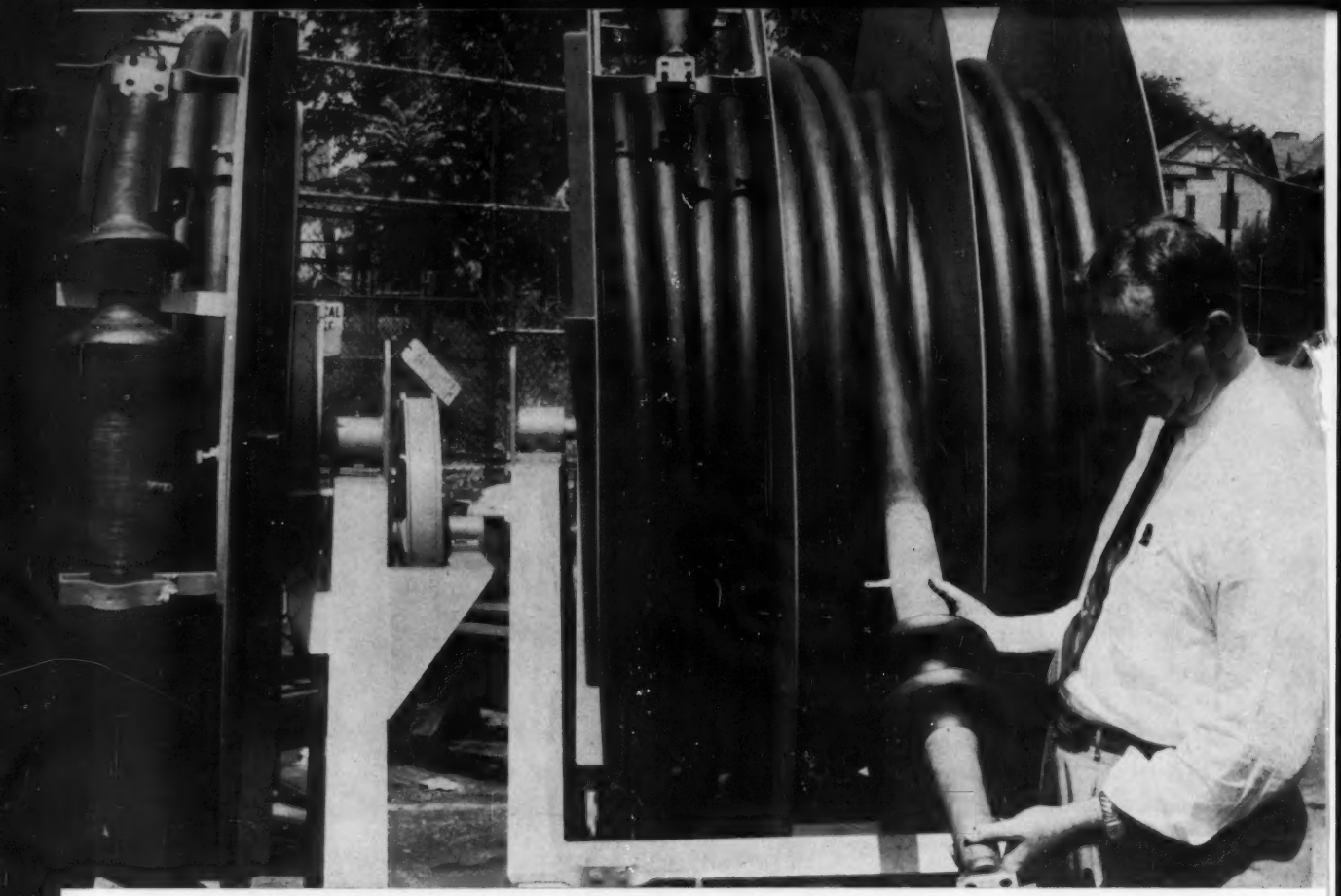


Okonite's portable substation cable showing factory-made terminations (bracket on specially designed reel holds one on left, while engineer examines another at right). Color coded terminations include vulcanized stress relief cones and insulators, ground straps and terminal lugs. They are ready for immediate use.

for substation emergencies or maintenance... use Okonite portable cable

Okonite portable substation cable has two important utility applications:

Emergency service—Cable is used to quickly connect mobile substations into existing lines when regular substation is out of operation. This reduces amount of service loss to consumers.

Maintenance—Portable substation equipped with Okonite cable maintains service to power users while substation is de-energized and serviced.

Advantages of Okonite portable substation cable:

Primary and secondary cables are available with heavy reinforced Okoprene sheath which provides extended service life. Sheath withstands mechanical strain caused by repeated winding, unwinding and dragging over the ground. Moreover, the extra flexible conductor and shielding braid provide easy handling under all weather conditions.

Cables are supplied in specified lengths with factory-made terminations at each end. (Type and style of terminal lug is specified by customer.) With these complete, factory-made terminations, the cable is ready for immediate service and can be connected in a matter of minutes.

Okonite cable can be supplied on specially designed steel reels, with conventional or bifilar wind (the latter enables cable to be unwound in opposite directions simultaneously). They can be immediately mounted on assigned truck and are provided with manual driving gear and brake for let-off and take-up.

For complete information about Okonite portable substation cable, write to The Okonite Company, Passaic, New Jersey.

available with copper or aluminum conductors

OKONITE OKONITE SINCE 1878 ***insulated cables***

3889

From the top of the pole to the bottom of the hole...

GET ALL YOUR POLE-LINE NEEDS FROM Graybar

Efficient procurement of pole-line equipment and supplies is assured when you order "via Graybar". Here — from a single, convenient source — you can select from the products of over 300 of the nation's leading manufacturers of quality electrical equipment. HUBBARD hardware, CRAPO strand and static wire, International Poles, RAINIER crossarms, RELIABLE connectors — plus tools, construction equipment and other pole-line needs specially-selected for utilities — they're all products you and your linemen know and respect.

No matter where the job site — populated urban districts or rugged rural areas — you're never far from one of Graybar's strategically-located offices or warehouses. Staffed by experienced personnel who understand your needs, Graybar offers you prompt efficient service on both orders and information requests.

On out-of-the-ordinary problems, Graybar Outside Construction Specialists are always on call and glad to lend a hand. Think of it this way: If your supply problem or engineering problem lies anywhere between the top of the pole and the bottom of the hole — call Graybar first. You'll find it pays.

429-93

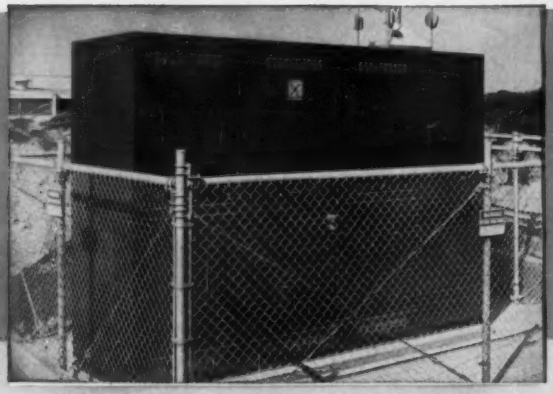
CALL GRAYBAR FIRST FOR...

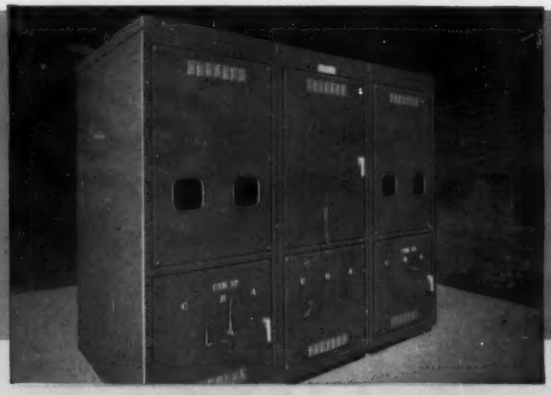
Graybar — Everything Electrical

GraybaR ELECTRIC CO., INC.
420 Lexington Ave., New York 17, N. Y.

IN OVER 130 PRINCIPAL CITIES

Now... metalclad primary gear for ...in one Low Cost





SIMPLIFY PREFERRED-TO-EMERGENCY SWITCHING WITH

S&C's new "Package" approach

Here is a simplified solution to the demands for uninterrupted service . . . a complete throw-over "package" that overcomes the disadvantages of previous methods that were unsightly, costly, and complicated. S&C's new package is compact, economical, and completely enclosed—ideal for distribution and industrial substation applications.

LOW COST—Standardized design and factory assembly techniques provide substantial savings. The entire system is factory tested and ready to set into place . . . no costly on-the-site construction, assembly, or check-outs to make.

SAFE—The tamper-proof metalclad unit prevents access to unauthorized persons. Thus it is suitable for residential and industrial areas.

ATTRACTIVE APPEARANCE—All sensing, switching, and protective devices are enclosed in a metalclad unit. There are no ugly motor-driven, pole-mounted switches. Simple lines, neutral finish, and compact, streamlined construction are in keeping with the planning of today's residential and commercial neighborhoods.

15-CYCLE AUTOMATIC THROW-OVER—Throw-over in case of an outage is accomplished in about 15 cycles or less, rather than the several seconds required with motor mechanisms.

FULL LOAD INTERRUPTION—S&C Load Interrupter components permit the entire load to be dropped at any time under any conditions except short circuit.

throw-over schemes

Package

A TYPICAL S&C THROW-OVER PACKAGE

Super-Durabake Finish is beautiful and long lasting . . . prevents rust and minimizes maintenance.

S&C Power Fuses protect transformer primary whether supplied by preferred or emergency source.

S&C Load Interrupter on preferred source opens on power failure.

S&C Load Interrupter on emergency source closes on power failure.

S&C Gear is a complete package ready for service. Just make up the potheads . . . no on-the-site engineering, assembly or testing required.

Potential Transformers sense both preferred and emergency sources . . . transfer occurs only if there is voltage on the alternate source. (Secondary sensing is optional.)

Control Panel and Operators (at rear of center section) provide for load transfer to an emergency source of power when there is a loss of voltage on the preferred source. With economical semi-automatic spring operators, the load is returned manually at the convenience of the operator. With optional hydraulic operators, back transfer occurs either when preferred voltage is restored or when a loss of voltage occurs on the alternate source.

S&C

Specialists in High-Voltage Switchgear for Electric Utilities since 1910

S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE • CHICAGO 49, ILLINOIS, U. S. A.

Consult your telephone directory. Sales offices in Birmingham, Boston, Buffalo, Chicago, St. Louis, Cleveland, Dallas, Dearborn, Denver, Houston, Huntington, Indianapolis, Jersey City, Kansas City, Little Rock, Memphis, Minneapolis, New Orleans, Philadelphia, Pittsburgh, Portland (Ore.), St. Petersburg, Salt Lake City, San Francisco, San Gabriel (Los Angeles), Seattle, Syracuse, Washington, D. C. In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario.

The Grinnell Model R Constant-Support Pipe Hanger is available now in an *extended range* of sizes to provide completely overlapping coverage of loads from 47 lbs. to 32,267 lbs., and with travels up to 12 inches. New design modifications permit these hangers to be installed with a minimum of headroom, ranging from 29 inches (rod take-out) for the largest size — down to 10¾ inches for the smallest size.

The Model R provides constant support which is mathematically perfect for all positions of travel. This constancy of support is maintained throughout the full range of field adjustability. Needle bearings minimize friction.

Grinnell Constant-Supports are individually calibrated to support the exact load specified. All Model R Constant-Supports have a full 70 percentage points of field adjustability built into them. No less than 10% of this adjustability is allowed either side of calibration for plus or minus change in load. Field re-adjustments are easily made by turning a single load adjustment bolt.

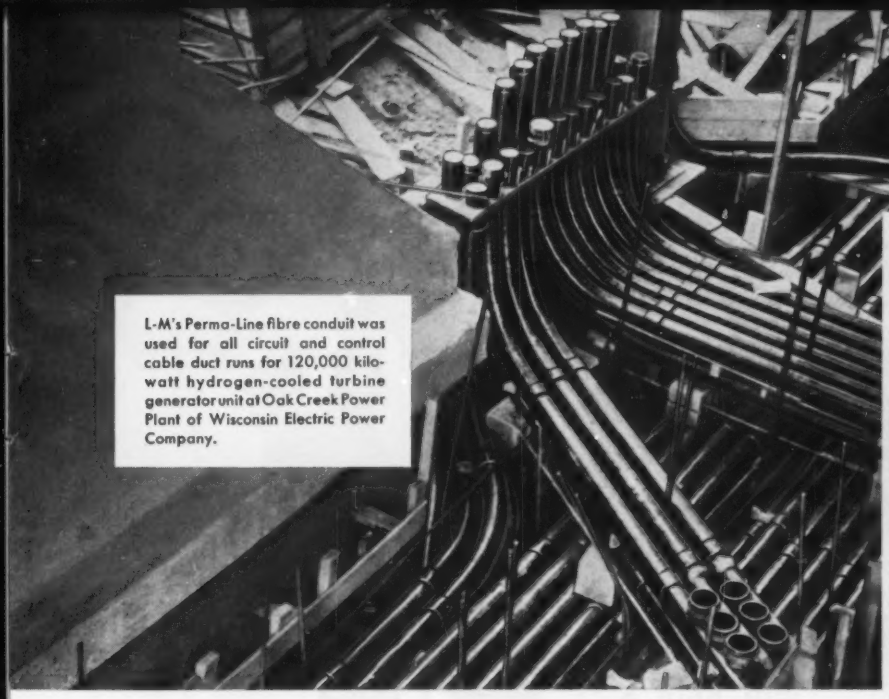
Grinnell designs, manufactures, and distributes a complete line of pipe hangers and supports for every piping requirement. Grinnell maintains an experienced staff of engineers in the field — ready to assist you on the job with any piping problem.

GRINNELL

AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPLIES

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems



L-M's Perma-Line fibre conduit was used for all circuit and control cable duct runs for 120,000 kilowatt hydrogen-cooled turbine generator unit at Oak Creek Power Plant of Wisconsin Electric Power Company.

Above, L-M's Perma-Line fibre conduit is being installed in the Burleigh Substation, Wisconsin Electric Power Co. Duct has smooth inner bore and smoothly rounded bell ends in manholes so cable sheath will not be cut or marred.

L-M's Perma-Line™ Conduit Assures a Lifetime of Trouble-Free Service

L-M's Perma-Line fibre conduit is manufactured within close tolerances and according to rigid test requirements to assure trouble-free service for all generating station, substation, and underground system applications.

L-M's Perma-Line is corrosion-, vermin-, and leak-proof. It has an unusually high tensile strength. Joints are quickly and easily made by simply tapping the tapered coupling onto the tapered end of the conduit. Joints are watertight and safe from seepage of wet concrete and soil water. L-M conduit's smooth inner bore makes cable easier to pull and reduces cable sheath abrasion. Fibre conduit comes in long lengths. It's light, easy to handle; and you'll find it can be laid faster than many other types of ducts.

Complete Accessories

Prefabricated base and intermediate spacer units are available to keep installations rigid and evenly aligned. Spacers have special locking feature to make any combination of duct configuration.

L-M provides a variety of bends and angle couplings, including 5° angle coupling, S-bend, 45° and 90° bends. The 5° angle coupling provides for long radius turns and offsets; S-bend provides a 20" offset. Special bends are available on order.

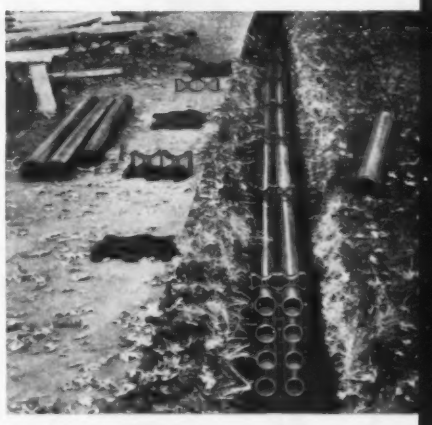
Bell ends for use at conduit terminals in manholes provide a smoothly rounded opening that will not cut or mar the cable sheath.

Fibre caps provide a watertight, vermin-proof seal for conduit lines prior to drawing cable. Easy to remove for reuse.

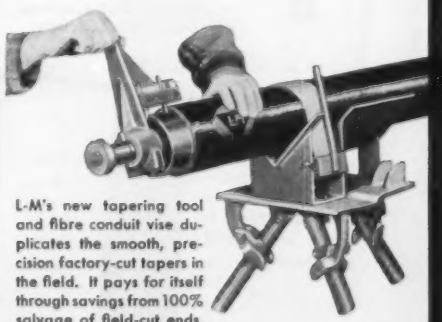
L-M Perma-Line fibre conduit is available in 5-foot lengths, sizes 2, 4, 5, and 6 inches; also 8-foot lengths, sizes 3, 3½, 4, 4½ and 5 inches.

Get Complete Information

L-M offers a completely engineered system for conduit installations. Ask the L-M Field Engineer for a copy of the 12-point plan folder, which shows how easy it is to use our system; also for L-M's underground construction handbook and Bulletin UG1A, which gives complete specifications. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



It is easy to construct a solid, well-aligned installation with L-M's Perma-Line fibre conduit and easy-to-use accessories. The illustration above shows use of L-M base and intermediate spacers, to assure firm, even spacing.



L-M's new tapering tool and fibre conduit vise duplicates the smooth, precision factory-cut tapers in the field. It pays for itself through savings from 100% salvage of field-cut ends.

LINE MATERIAL

Fibre Conduit

226-R

L-M's new Luminaire Supports will hold a 250-pound man!

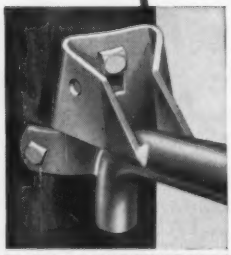
Here's the first complete line of brackets designed specifically to meet customers' requirements for strength, *minimum pole space* (less than the rise of the bracket), and handsome appearance.

Obviously we didn't design them for a gymnasium—but they *are* strong enough so that even the extra-long 20-footers will support a 250-pound man, if he should accidentally put his weight on the end of the arm. Pole plates and tension support members are all welded to the unit to insure ample strength throughout the entire assembly. These designs have all been wind-tunnel-tested for winds up to 150 MPH to assure generous lateral strength.

Pole space required is only one inch per foot of bracket length—except on A-frame brackets, which require not over 1.6 inches per foot. In other words, a 10-foot bracket requires only 10 inches of pole space. The 20-foot A-frame bracket shown above requires only 30 inches of pole space. Installation instructions are marked directly on the support arm.

Units are easy to handle, install, and wire. The entire line is related in appearance so that you can use several types in the same installation, if desired. All types are available in galvanized steel or aluminum; choice of plain, threaded, or street-ell end styles.

Four harmonizing styles of supports, available in various lengths up to 20 feet, in steel or aluminum. Get details on sizes available in each style.



Upper photo: Strong pole fitting has ample strength; held by ⅝-inch thru-bolt and 2½-inch lag screws. Lower: welded support for braces adds strength, minimizes vibration.

Get Complete Information on L-M Street Lighting Application Service

These are the only brackets that have all three advantages—extra strength, minimum pole space, and handsome design. L-M also offers a full line of street lighting luminaires—incandescent, mercury vapor, and fluorescent—and complete street lighting application engineering service. Ask the L-M Field Engineer for information and bulletins. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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LINE MATERIAL
Street Lighting

The lamp and socket swing down as part of the glassware assembly, become automatically de-energized for quick, Service-Safe re-lamping during circuit operation.

The refractor assembly swings wide open on the house side, for easy re-lamping. Refractor assembly can be removed easily but not accidentally.

Make-before-break action of contacts . . .

L-M's New Series Ovalite is Automatically De-Energized with New Service-Safe Feature

Both lamp and socket are automatically de-energized and isolated from series circuit when glassware swings down. Make-before-break action of contacts in series luminaire eliminates arcing.

By **DEAN W. MORRILL**, Lighting Application Engineer, Line Material Company

L-M's new mercury vapor Ovalite offers outstanding design features for safe, economical servicing of the luminaire, in addition to its efficient light distribution.

The lamp and socket swing down as part of the glassware assembly; as the socket leaves the receptacle, it becomes automatically de-energized, and much more accessible for quick, safe re-lamping of the luminaire during circuit operation, saving service time.

Contacts on the series Ovalite are so designed that there is a make-before-break action, which means the lamp connections are shunted before they are disconnected. In restoring the connection the same principle applies. The lamp connection is made before the shunt is opened, eliminating arcing.

The contacts are silver-plated beryllium copper; socket is steatite; receptacle is wet-process glazed porcelain with a 5,000-volt insulation rating which meets EEI-NEMA specification of 19,000 volts withstand.

This new Ovalite provides a choice of horizontal or pendant mounting for mercury vapor; choice of types III or IV light-distribution patterns.

The Service-Safe feature of L-M's Ovalite is available in both multiple and series luminaires.

Get Complete Information

This series luminaire is specifically designed for the Uni-Ballast system. Ask the L-M Field Engineer or Lighting Engineer for information on the new L-M Ovalite; on Uni-Ballast, the most economical system for mercury vapor lighting; and on L-M's Lighting Recommendation Service. Or write Line Material Co., Milwaukee 1, Wis. (a McGraw Electric Company Division).

"Ovalite," "Uni-Ballast" and "Service-Safe" are Line Material Company trademarks.

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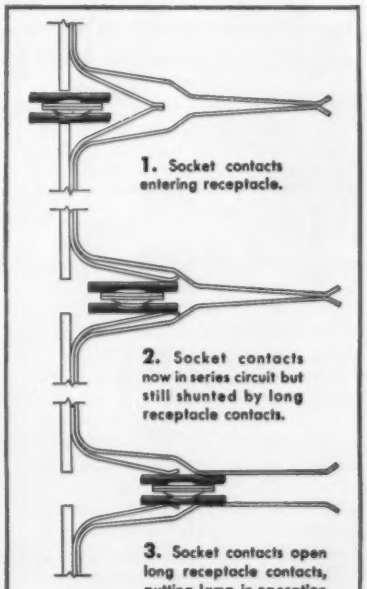

1. Socket contacts entering receptacle.
2. Socket contacts now in series circuit but still shunted by long receptacle contacts.
3. Socket contacts open long receptacle contacts, putting lamp in operation in series circuit.

NOTE—Procedure is reversed when socket is withdrawn during luminaire opening. Lamp is shunted before being withdrawn from circuit. This make-before-break action eliminates arcing.

LINE MATERIAL
Street Lighting

Now 150 kva on Single Pole. You can hang three L-M light 50 kva obround transformers on a single-pole structure, obtaining 33⅓% more capacity and 15% less bending moment on the pole than with three 37½ kva round tank design transformers.

How L-M Obround Design Provides Additional Capacity On Structures

New obround tank design is smaller, lighter, has shorter moment arm, retaining all outstanding Round-Wound® performance characteristics.

By **ALVIN B. COYLE**
Product Manager
Transformers
Line Material Company

Now you can hang transformers of larger capacity on a pole structure with L-M's lighter, smaller obround transformer tank design. The additional capacity is obtained without changing outstanding performance characteristics of L-M's Round-Wound design.

Less Weight

The obround design provides a smaller tank with less transformer oil, resulting in a lighter, easier-to-handle transformer. Cooling tubes are installed where necessary to provide the cooling surface for maintaining the same low hot-spot and top oil temperature-performance characteristics found in all other L-M transformers. In addition, the transformer's repetitive overload capacity is improved as the result of the faster transfer of heat from the coils to the cooling air.

Shorter Moment Arm

L-M's new obround design brings the center of gravity closer to the pole, which reduces the moment arm distance from the pole. The combination of lighter weight and less moment arm distance substantially decreases the total bending moment on the pole and crossarms, and thus greatly increases the potential capacity of all your transformer structures.

You can take advantage of savings such as these:

Larger transformers can be hung closer to the top of the pole, eliminating the need for a higher pole and additional spacing.

Single-pole, three-phase transformer structures can now serve more load with the additional transformer capacity available. New 50 kva obround transformers have less bending moment on the pole and on crossarms than previous 37½ kva round tank design. Here L-M's light obround transformers may eliminate the need for costly two-pole structures.

Pole-Mounted 167 kva Transformers

L-M's light-weight 167 kva transformer can be pole-mounted; provides a full 167 kva of capacity on a single-pole structure. And it, too, provides L-M's well-known overload capacity.

To serve three-phase loads you can hang three L-M light 167 kva transformers or 500 kva on a two-pole structure, eliminate expensive platforms, ground pads, or vaults in many instances, and make further use of existing facilities.

L-M's light, obround design transformers are available in single-phase 5 kva through 167 kva in each standard distribution voltage class.

Get Details On Lighter-Weight Obround Transformers

Ask the L-M Field Engineer for application information, weights and dimensions on L-M obround transformers and the exclusive Round-Wound design. Or write Mr. Coyle at Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

LINE MATERIAL Transformers

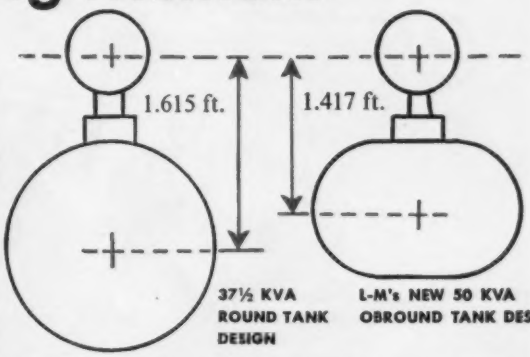
You Can Hang 33⅓% More Capacity With 15% Less Bending Moment

COMPARE 37½ kva round tank design
50 kva L-M obround tank design

37½ kva ROUND tank design:
Moment arm from center of pole. 1.615 ft.
Weight. . . . . 800 lbs.
Bending moment 800 x 1.615. . . . **1292 ft.-lbs.**

50 kva L-M OBROUND tank design:
Moment arm from center of pole. 1.417 ft.
Weight. . . . . 775 lbs.
Bending moment 775 x 1.417. . . . **1098 ft.-lbs.**

L-M's new 50 kva obround transformer has 15% less bending moment than the 37½ kva round tank design.



Less Bending Moment—New obround tank design reduces the moment arm distance from the pole. The combination of lighter weight and smaller moment arm distance greatly decreases the total bending moment on the pole. When crossarm mounted, the lighter weight substantially reduces the bending moment on the crossarms.

Less Weight, Faster Cooling—The obround design affords a small tank and less transformer oil, resulting in a lighter, easier-to-handle transformer. Cooling tubes are installed where required to provide sufficient cooling surface.

In addition, oil ducts, located throughout the coil and between the coil and cruciform cross-section of the wound core, contribute to uniform efficient cooling.

Rapid transfer of heat provides faster cooling of the unit, increasing its repetitive overload capacity.

Plus Outstanding Round-Wound Performance Characteristics

Both the physical and performance characteristics of L-M's obround tank transformer were considered in detail. The advantages of lighter weight and shorter moment arm were accomplished with no sacrifice of outstanding Round-Wound performance characteristics.

Low Exciting Current: the continuously wound core of oriented-grain silicon steel strip provides a uniform flux path, thus permitting low exciting current.

High Impulse Strength: high-voltage windings are on the outside of the coils, providing maximum distance between the high-voltage windings and the core. This permits ample creepage distance with generous insulation.

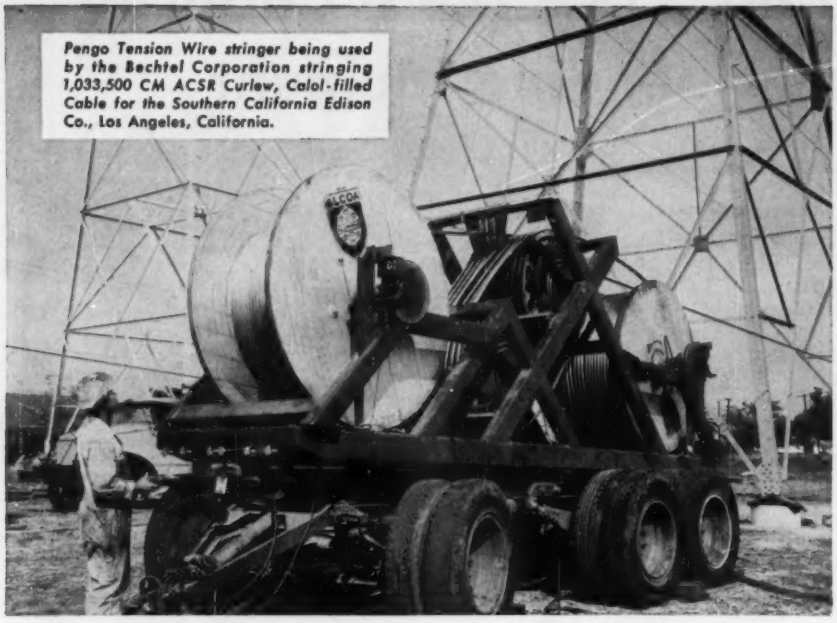
High Short-Circuit Strength: round coils naturally resist radial short-circuit forces without damage or distortion. Sturdy core clamps and strong blocking aid in preventing axial movement of the windings under short-circuit conditions.

High Short-Time Overload Capacity: cruciform cross section of wound core and ducts between windings and layers provide excellent cooling for the entire unit.

Now you can hang 167 kva directly on the pole, yet L-M's new lightweight obround has full 167 kva continuous rating and no sacrifice in overload capacity.

LINE MATERIAL
LM Transformers

219-R2



Pengo Tension Wire stringer being used by the Bechtel Corporation stringing 1,033,500 CM ACSR Curlew, Calol-filled Cable for the Southern California Edison Co., Los Angeles, California.

The latest method of stringing conductors

- ***Safest, most economical for transmission, distribution and even secondary lines.***
- ***Its greatest savings are effected when stringing over and through energized circuits... by far the safest, too!***

Operation of the PENGO Tension Wire Stringer is almost unbelievably smooth. Because the tensioning is done on the Neoprene-Lined Bullwheels rather than on reels, conductor damage from the reels has been eliminated entirely. Due to the Neoprene lining of the Bullwheels, it is possible to use a full range of wire sizes to maximum groove capacity, which, in the case of the Model 6000-WS shown in picture, is Pheasant or 1⅜" diameter.

SMOOTH, POSITIVE CONTROL OF CONDUCTOR TENSION can be maintained at all times regardless of model or size of PENGO Tension Wire Stringer used. The large, specially designed PENGO disc brakes are mounted away from the Bullwheels to assure dissipation of the heat generated by the continuous braking action and prevent transmission of the heat to the Bullwheels.

In addition to the model shown in the picture, all series are available in low-slung trailer mounts for mountain work with separate easy-loading reel trailers.

List your requirements and send for descriptive literature and prices.

PETERSEN ENGINEERING CO.
Santa Clara, California Dept. 4
Please send me more information on the new Pengo Tension Wire Stringer.
Name_____
Firm_____
Address_____
City_____ State_____

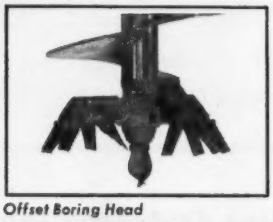
Made by the makers of the World-Famous
PENGO EARTH AUGERS

PETERSEN
ENGINEERING COMPANY
Santa Clara, Calif.

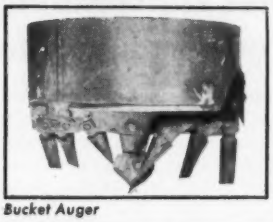
Other PENGO Products include:

24 inch Heavy Duty Flight Auger

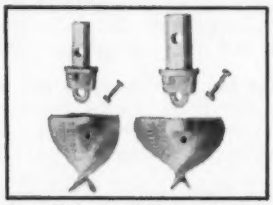
Double-Helix Heavy Duty Auger



Offset Boring Head

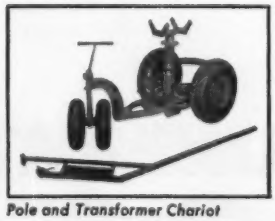


Bucket Auger



Screw Bit for Small Diameter Holes

Pulling Eye



Pole and Transformer Chariot

Please note that this is NOT a special sale! Bargains like this are yours for the asking the year 'round when you specify Pennsylvania *Standard Parts* Power Transformers. You can save as much as *8% of the basic price* of a conventional power transformer rated 69 kv and below . . . and the sizes range from 833 through 5000 kva, single phase, and from 750 through 10,000 kva, three phase. You have a wide choice of voltage combinations and accessories, too . . . with little effect, if any, on price.

Check the other outstanding advantages of *Standard Parts* Power Transformers . . . then check your pending power transformer needs. If your system requirements permit using the kva sizes, voltages, impedances, and accessories within the range of standardized units outlined in ASA Standards C57.12b, it will pay you to specify Pennsylvania *Standard Parts* Power Transformers.

- **GET QUICKER DELIVERIES...** because designs are already made up, and many standard parts are kept in stock.
- **SAVE ON INSTALLATION...** because most Standard Parts Power Transformers are shipped completely assembled.
- **SAVE ON MAINTENANCE...** because Pennsylvania Standard Parts Power Transformers feature all-sealed construction, with no auxiliary tanks and fittings to maintain.

PENNSYLVANIA TRANSFORMER COMPANY
A McGraw Electric Company Division CANONSBURG, PA. Greater Pittsburgh District

NOT ALL

DRY-TYPE TRANSFORMERS ARE UNDERWRITERS' APPROVED NOR ARE THEY ALL ALIKE

Check the Underwriters' Laboratories list of approved transformers

• *Underwriters' Approved*

SORGEL air-cooled transformers are Underwriters' approved in ALL RATINGS (not just a few) covered by the Underwriters' Re-examination Service, both single phase and 3-phase. Only one other make of 3-phase transformers is Underwriters' Approved.

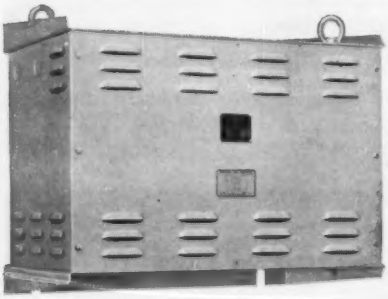
All SORGEL transformers are constructed according to the latest Underwriters' Laboratories standards. They also meet all the requirements of the ASA, AIEE, and NEMA standards.

• *Not Just an Ordinary Transformer*

SORGEL dry-type transformers are not just ordinary transformers that were converted to follow the trend toward air-cooled transformers. SORGEL dry-type transformers are designed and constructed especially for indoor installations close to load centers.

COMPLETE LINE

¼ Kva to 2500 Kva, single phase.
1 Kva to 3000 Kva, 3-phase, 2-phase and phase changing.
All standard voltages, such as 120, 208, 240, 480, 600, 2400, 4160, 4800, 7200, 13,200, up to 15,000 volts, and any intermediate or special lower voltages.



15 to 50 Kva 3-phase. Wall mounting type

¼ Kva single phase 480/240 to 240/120 volts

SORGEL transformers, by tests, comparisons and experiences, proved to be the best.

That there is a difference in dry-type transformers was revealed in the findings of a survey made by Plant Engineering, a trade publication, which mailed 500 questionnaires to users of air-cooled transformers. (A copy of this survey report will be sent on request.)

• *Liberal Design for Full Rated Load*

SORGEL air-cooled transformers are guaranteed to carry the full rated load continuously at a safe, low operating temperature, and are so liberally designed that they can safely carry an overload during an emergency.

• *Quiet operation*

The sound level is well below the established standards. Because of their quiet operation, SORGEL transformers are particularly adaptable for indoor installations close to load centers, and where low sound levels are an important factor.

• *Long Life*

Thermo-vacuum impregnated windings are brazed to terminals.

• *Easy and Low Cost Installation*

All self-contained in a single unit, either single or 3-phase, with simple connections to make. No separate mounting brackets to make or buy. Substantial wall brackets or floor mounting base are an integral part of SORGEL transformers. Equipped with solderless terminal lugs.

• *Rugged Construction*

All fabricated steel frames and enclosures. No castings or flimsy enclosures that might be broken or damaged during shipping or handling.

SORGEL TRANSFORMERS

Stock carried by jobbers in the following cities:

New York, N. Y.	Cincinnati, Ohio	Louisville, Ky.
Buffalo, N. Y.	Cleveland, Ohio	Cedar Rapids, Iowa
Roxbury, Mass.	Chicago, Ill.	Davenport, Iowa
High Point, N. C.	Rockford, Ill.	Omaha, Neb.
Raleigh, N. C.	Rock Island, Ill.	Beaumont, Texas
Philadelphia, Pa.	Richmond, Ind.	Los Angeles, Calif.

Consult the classified section of your phone directory or write to factory

SORGEL ELECTRIC CO., 834 West National Ave., Milwaukee 4, Wisconsin

40 years' experience in the development, manufacturing and application of transformers

Butyrate conduit is so light that one man can easily lift six 20' lengths, 2" in diameter.

Slip-sleeve couplings and solvent cement join lengths of Butyrate conduit quickly and permanently.

Butyrate conduit can be covered with concrete or subjected to any normal backfilling operation.

Butyrate's resistance to corrosive and electrolytic attack permits installation even in strong alkali soils.

Flexibility of Butyrate conduit permits it to follow ditch contours without the use of fittings—even a 90° bend, as here.

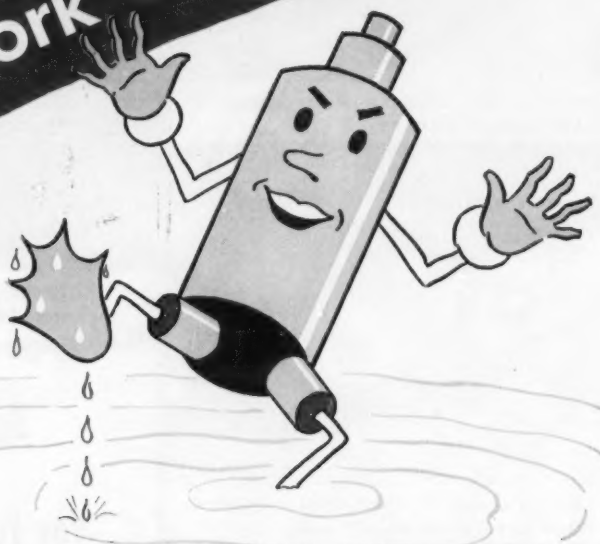
Specify Tenite Butyrate cable conduit for faster, easier installations that last longer

Cable conduit made of Tenite Butyrate offers you these specific advantages over ordinary conduit: It can be handled, cut and joined with ease and can be bent around most obstacles — which means that installing conduit for power lines and telephone cable need no longer be a long or expensive process. It has an impact strength often lacking in other materials and in service, is unaffected by corrosive or electrolytic action of soil — your assurance of long years of trouble-free service.

Find out how cable conduit of Tenite Butyrate can save you time, labor and money. For more information and the names of manufacturers supplying Tenite Butyrate conduit, write: EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

TENITE
BUTYRATE
an Eastman plastic

How to put "WEBBED FEET" on Network Cables



Water entering ducts floods low voltage network circuits as quickly as it engulfs high voltage primaries.

That's one reason why Simplex Network Cables are insulated with Anhydrex. It's also an excellent reason for you to buy them.

Anhydrex is guaranteed to absorb no more than 20 milligrams of water when soaked for seven days at 158°F.

You can keep your amperes dry as a bone by getting Anhydrex-insulated, neoprene-jacketed, Simplex-ANHYDREX Network Cable. Use it for direct burial, in ducts, or above ground suspended from messenger wire.

For more information about Simplex Network Cables, write to the address below. Ask your nearest Simplex distributor about his complete line of ANHYDREX Cables.

Simplex–ANHYDREX

NETWORK CABLES

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Mass.

ELECTRICAL BUSINESS OUTLOOK

Electrical World
APRIL 2, 1956

About one out of every six new homes built in 1965 will be weather-conditioned by heat pumps forecasts an important industry producer. This means selling 210,000 heat pumps (85% residential) to a market of 1.2 million new homes expected to be built in 1965. Backing up this forecast is a prediction of lower prices and a wider range of sizes—possibly 2, 3, 5 and 7 ton units.

This year the industry expects sales to jump from a modest 4,500 units in '55 to 10,000 units. Sales will split at 55% residential and 45% commercial—the same as last year. Actually booming commercial construction and an increasing demand for more comfort in new homes makes these estimates appear conservative.

• • •

Consumers will pay more for copper products. Anaconda's new policy of selling Chilean copper in the U. S. and abroad on a uniform price basis means just that. If basic copper prices in U. S. and abroad come anywhere near equalizing, European cost advantages (principally labor costs) will come to the fore. Here at home substitution of other materials for copper will be stepped up. The leading candidate . . .

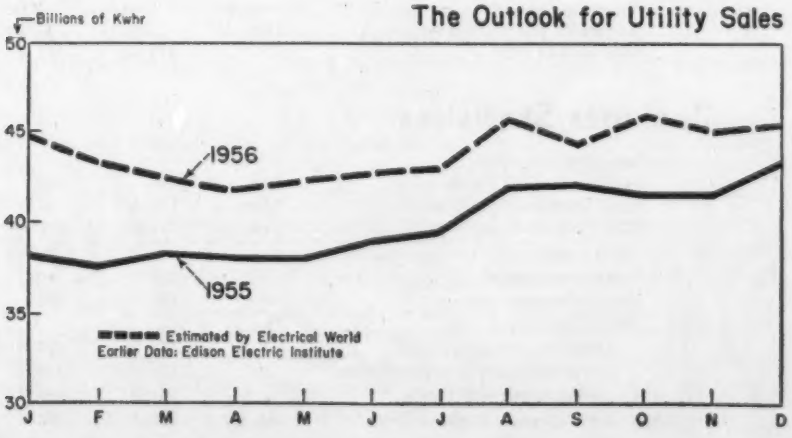
Aluminum is also in tight supply. Last week's price boosts of 1½¢ per lb bear witness to the tightness of the market. Even so, primary aluminum still sells at about half the price of copper with no serious price rise in view—at least before the second half of the year. Then higher prices appear to be a certainty. Prices will reflect increased production costs (mostly wages) due to hit around July 1. Another factor will be the need to generate more capital for expansion through retained earnings now that the government policy of rapid depreciation has lapsed.

And expansion won't be at a snail's pace. Aluminum Company of Canada estimates U. S. primary aluminum capacity will hit 2,318,500 tons by 1960. That's a jump of 48% over the 1,566,000 tons at the end of '55.

• • •

This should be another good year for appliances—and other durable goods. The yearly Federal Reserve Board Survey of consumer finances shows consumers are planning to back up sales forecasts. The same percentage plan to spend the same amount on major appliances and furniture as in the '55 survey.

The Outlook for Utility Sales



STATISTICS

U.S. Gross Marginal Capacity in 1955 Hit Low of 18.5% in December

(Margins in % Based on Dependable Capacity Under Average Water Conditions)

REGIONS	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
I	23.8	24.1	26.8	30.9	30.0	29.4	28.2	23.3	26.8	27.6	17.3	11.8
II	22.6	23.9	24.2	24.0	23.7	23.5	21.0	18.4	21.6	16.9	11.7	13.1
III	17.4	15.5	21.5	27.8	27.0	23.7	22.6	25.0	29.5	26.1	18.4	17.9
IV	19.3	21.6	22.5	25.5	24.1	25.4	22.2	21.6	26.0	27.5	20.2	16.3
V	63.6	63.8	62.4	54.6	47.1	37.1	26.3	21.8	29.0	48.9	52.9	53.8
VI	39.4	46.6	51.6	53.5	50.7	48.9	32.0	31.4	48.3	52.2	36.1	32.9
VII	9.1	20.5	23.5	27.0	25.8	25.7	28.5	30.4	23.7	18.6	6.9	8.3
VIII	30.6	33.5	28.3	27.6	34.6	26.6	22.6	21.0	17.4	27.9	28.4	27.9
TOTAL U. S.	24.6	26.2	27.9	30.1	29.5	27.3	24.4	22.8	25.6	26.1	20.0	18.5

Source: Edison Electric Institute

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Jan.	114.55	114.37	103.62	10.5
Peak—Class I Systems (million kw)	Dec.	98.2	96.4	85.7	14.6
Estimated Dec. '56 Peak (million kw)	Dec.	105.27	104.55	102.64	2.6
Production—billion kwhr	Jan.	51.12	50.72	43.96	16.3
Hydro		9.36	9.31	9.43	−0.7
Fuel		41.76	41.41	34.53	20.9
Sales—billion kwhr	Dec.	45.19	43.07	38.06	18.7
Residential		12.25	10.71	10.89	12.5
Commercial		6.81	6.61	6.19	10.0
Industrial		23.75	23.37	18.75	26.7
Other		2.39	2.38	2.23	7.2
Fuel Consumption	Jan.				
Coal—million tons		15.22	14.77	12.02	26.6
Oil—million barrels		8.22	8.54	8.91	−7.7
Gas—billion cu ft		68.27	70.00	65.13	4.8
Net Income Class A & B Co's—$ million	Nov.	104.29	95.67	95.12	9.6
Residential Customers—millions	12 mos.	44.41	44.30	43.14	2.9
Revenue per kwhr	ended	2.64¢	2.65¢	2.69¢	−1.9
Avg kwhr per customer	Dec. 31	2,751	2,728	2,549	7.9
Avg annual bill		$72.63	$72.29	$68.57	5.9

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Feb.	144	143	135	6.7
ENR Construction Cost	Mar.	142.8	142.6	135.4	5.5
BLS Cost-of-living	Feb.	114.6	114.6	114.3	0.3
NEMA Sales	Jan.				
Insulation materials		159	160	132	20.5
Electric appliances		105	101	108	−2.9
Wholesale prices	Dec.				
Motors and generators		127.2	127.0	121.8	4.4
Transformers and regulators		129.2	129.2	128.1	0.9
Switchgear and fuses		145.9	145.9	135.3	7.8
GNP—annual rate—$ billion	4th Qtr.	397.3	392.0	367.1	8.2

Your Business

The approaching hot weather raises the perennial question for men: Is it possible to buy a summer suit that looks well, is very cool, can be thoroughly cleaned, and is moderately priced? The answer is no, according to research by McGraw-Hill's economics department. You have to sacrifice something.

If you want to concentrate on appearance with some degree of coolness, buy yourself a tropical worsted or tropical wool-Dacron blend. They are fairly high priced but look and wear well. But if you are more interested in coolness than appearance, try one of the newer synthetic cords that have some rayon, nylon, or Orlon mixed in. The cords are less expensive but have some negative features. They have to be cleaned frequently.

Brooks Bros, New York's distinguished clothier, is convinced that in the long run—after the initial investment—the tropical worsted or tropical wool-Dacron won't cost any more than the synthetic cords. Over a period of years the more expensive suit will look better and won't have cost any more than the several cords required in the meantime.

Talking about clothes brings to mind Benjamin Franklin's advice on the subject, regrettably not entirely acceptable in today's business world:

"When you incline to have new clothes, look first well over the old ones, and see if you cannot shift with them another year, either by scouring, mending, or even patching if necessary. Remember a patch on your coat, and money in your pocket, is better and more creditable than a writ on your back, and no money to take it off."

Money in the pocket or not, appearance cannot be ignored. However, it should be kept in proper perspective. William J. Reilly, industrial consultant, discusses this in his booklet "What Do People Really Think of You?" (Prentice-Hall, Inc, New York). How we look and what we wear don't interest other people in our offices nearly as much as we think, he contends. His point is that when we wonder what people we work with think of us we should be more concerned about personal qualities and less with the superficial things, like our clothes.

Reilly's advice to gain recognition: Develop a reputation for getting things done, don't step on other people's ideas, "hold your fire"—don't always jump on people, and "look for the good points in people and for any of their achievements that can be praised."

Your Health

REX H. WILSON, MD, Medical Director, B. F. Goodrich Co

It is ironical that industry keeps many young men who are mentally and physically unfit and retires "oldsters" who are capable of performing well for many years.

A man of 90 may be more mentally alert than a man of 50. As we grow older our blood vessels harden and degenerate. The rate of change varies. A 45-year-old salesman who looked to be 65 kept falling asleep. His productivity had fallen off. He was tired and worn out. Even alcohol did not help. He was discharged, but he should have been retired.

Loss of blood supply to the brain results in a dulling of mental alertness and a lessening of energy. The patient tires easily, is less productive, and is usually depressed. Emotional tension, dizziness, impairment of hearing, headaches, fainting spells, and difficulty in sleeping are signs, also. The blood pressure is elevated in many. If the diseased blood vessels become blocked, paralysis, and in some cases death, may result.

The treatment of people with hardened arteries of the brain includes proper job placement. Many are not able to carry responsibility. Their judgment is poor, and their productivity is lessened. Increased rest periods, frequent vacations, fewer responsibilities, moderate dietary habits, moderation of smoking and drinking, and avoidance of exhaustion benefit many.

Each of us should expect to be affected differently by the inevitable aging process. We should adapt ourselves to our bodies and enjoy each day to the best of our abilities.

WASHINGTON COMMENT

Power Lack Seen in Federally Operated Areas

Recent FPC figures predict shortages in Northwest, TVA areas in near future; McGraw-Hill study of electric, gas utilities shows 16% rise in plant spending

The power situation in those areas where federal operations predominate is going to get worse before it gets better—if it gets better.

This is clearly demonstrated by the latest Federal Power Commission statistics.

The Northwest and TVA-area shortages could hit in the next two or three years (see table below). They have been recognized for some time. The government's attempts to provide new capacity for TVA, through the Dixon-Yates contract, then through the current revenue bond financing proposal, show this. The campaign to get new dams in the Northwest indicate awareness of that area's plight.

Federal paternalism is shown toward these two regions because they are served by predominantly government power grids.

FPC's projections for 1958 are based on industry's own plans for new capacity, and it takes about 30 months to build a new plant.

Fortunately, utilities which last year had shown a tendency to ease off on their ordering of heavy equipment are now planning large outlays in the next few years. This optimism is not reflected in FPC's figures.

McGraw-Hill's economics department, basing its estimates on its own surveys and those of the Commerce Department, Securities & Exchange Commission, and the Chase National Bank, had come to the conclusion last November that utilities (electric and gas) would institute a 10% cut in plant spending this year compared with 1955. Now, they reflect a 16% rise.

FPC's annual report, just issued, carries this warning: By 1980, load will exceed 310 million kw; if industry is to meet this, and carry the 15% reserve considered necessary in peacetime, it must boost its plant from the 102-million kw level of 1954 to a booming 360 million kw in the next 25 years. It's quite a challenge.

Regional Reserve Capacity (December)

REGION	1955	1956	1957	1958
I	11.9	11.9	13.0	15.7
II	11.7	15.3	14.4	12.2
III	17.5	13.1	9.9	6.0
IV	16.1	14.4	12.9	15.8
V	53.1	51.9	46.4	47.3
V (Summer peak)	20.0	19.1	14.2	13.7
VI	31.4	18.9	21.5	15.2
VII	8.4	−0.9	−0.5	3.8
VIII	31.3	21.0	20.0	21.8
Total U. S.	18.4	16.2	15.1	15.3

Note: FPC figures are based on adverse water conditions.

TECHNICAL NOTES

Rain drops boost RI on transmission lines almost as much as tack points. Snow has similar effect, but ice causes no appreciable increase.

Delta-connected primaries on network transformers permit fault locating by tracer current without isolating the transformers.

Wrapping cable sheath with wax-impregnated cheesecloth checks chemical attack of fireproofing compounds on the lead.

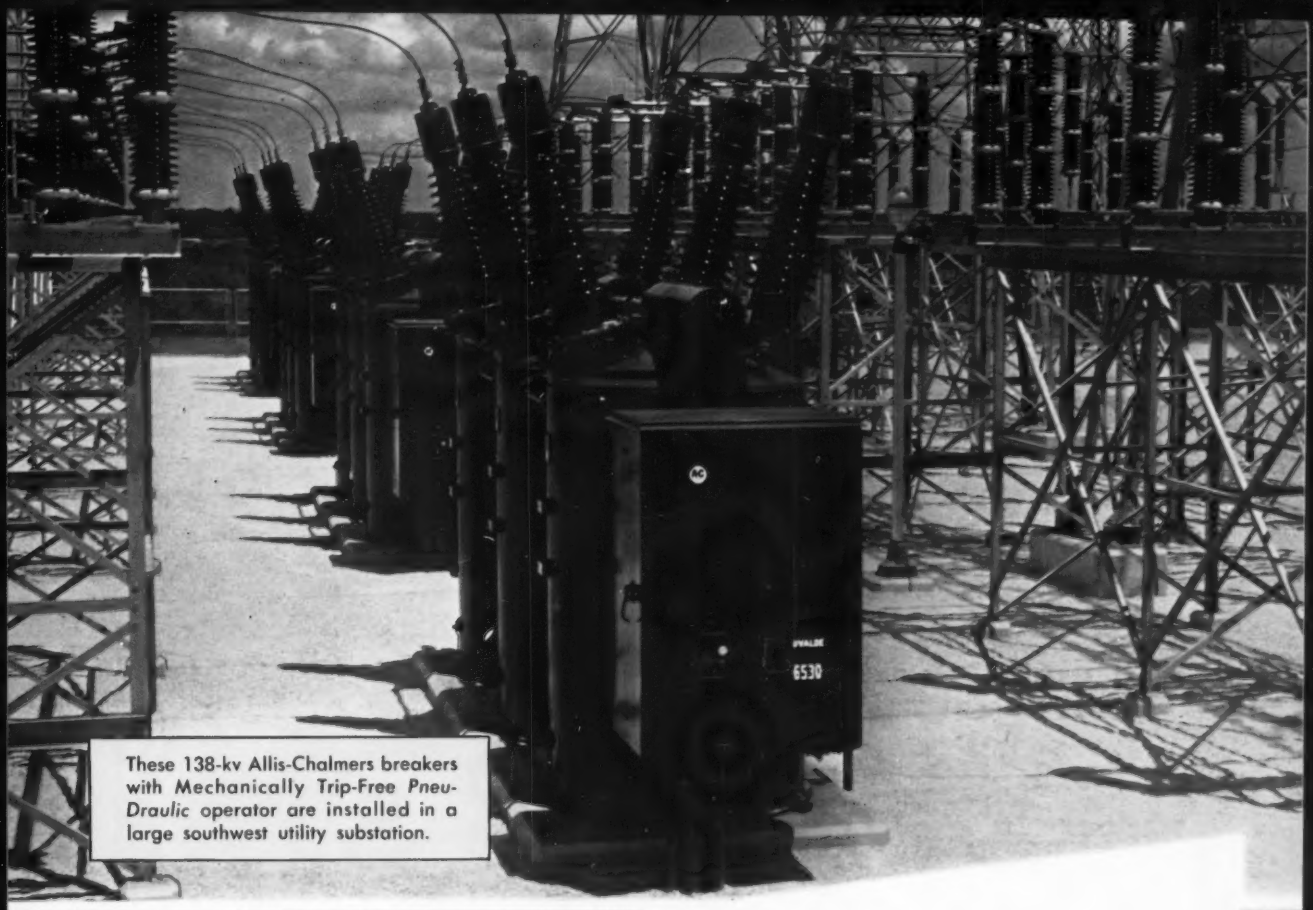
Bird holes in poles, if found before they are too large, can be rendered harmless with pole butt preservative compound sealed in with a metal plate.

Load capability of a constant-current transformer depends upon its impedance, its input kva, and the pf of its load.

A oak 4 x 4 lashed to a pole as a temporary gin gives height for hot-stick replacement of crossarms on H frames.

Decontamination of unpainted concrete is difficult after a reactor incident.

Slurry, the residue from coal washing, contains some 20% of coal fines after moisture is driven off. The Scotch enrich it with other low grade fuel and fire it in power plant boilers.



These 138-kv Allis-Chalmers breakers with Mechanically Trip-Free *Pneu-Draulic* operator are installed in a large southwest utility substation.

You Get MORE Positive Protection with Allis-Chalmers Mechanically Trip-Free Breakers

this breaker **Mechanically Trip-Free** FOR **POSITIVE PROTECTION**

Pneu-Draulic and *Turbo Jet* are Allis-Chalmers trademarks.

● All Allis-Chalmers breakers are fully Mechanically Trip-Free. Only in Mechanically Trip-Free breakers are contacts and closing mechanism uncoupled . . . enabling contacts to open at full rated speed without restriction from mechanism . . . under *all* conditions. Pneumatically or hydraulically trip-free breakers cannot give you this protection.

Time-Proved

Allis-Chalmers has used this simple operator mechanism principle since 1933.

Get details on this and other features of Allis-Chalmers breakers, such as the *Pneu-Draulic* operator and the completely tested *Turbo Jet* interrupting device. Call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-4979

OVER 400 RATINGS

Select Your Instrument Transformer Needs from Wide Range of Types

Get top quality, wide selection, quick delivery from Allis-Chalmers! Select dry-type, oil or compound-filled units, depending on transformer rating, application and location indoors or out.

Features include liberal electrical design on all types. High voltage types incorporate corona-free design. All Allis-Chalmers metering transformers have high accuracy.

Get Dimension Sheets

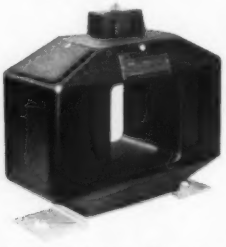
All pertinent mechanical and electrical information is in convenient data sheets. It is yours for the asking. Call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Outdoor current transformer, type KO, rated up to 15 kv, 800 amp.

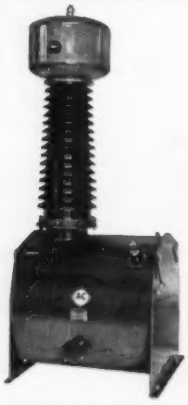
Molded current transformer, type BKM for 1200 and 1500 ampere indoor or outdoor use, 600 volts.

Molded current transformers, type TWM for 200, 400, 600 and 800 ampere, indoor or outdoor use, 600 volts.

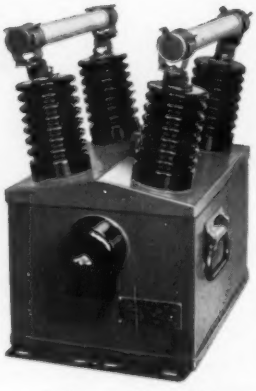
Oil-insulated outdoor current transformer, type SCW for 25 kv to 138 kv.



Molded current transformers, type BKM for 2000, 3000 and 4000 ampere application, 600 volts.



Oil-insulated outdoor potential transformer, type SPW for 25 kv to 138 kv.



Indoor potential transformer, type PD, rated up to 14,400 volts, fused or unfused.

A-4958

ALLIS-CHALMERS

Carrying coal in Delaware Valley with U.S. Rubber Conveyor Belts

(at right) U. S. Giant® Conveyor Belt, carrying coal from car dumper to breaker house.

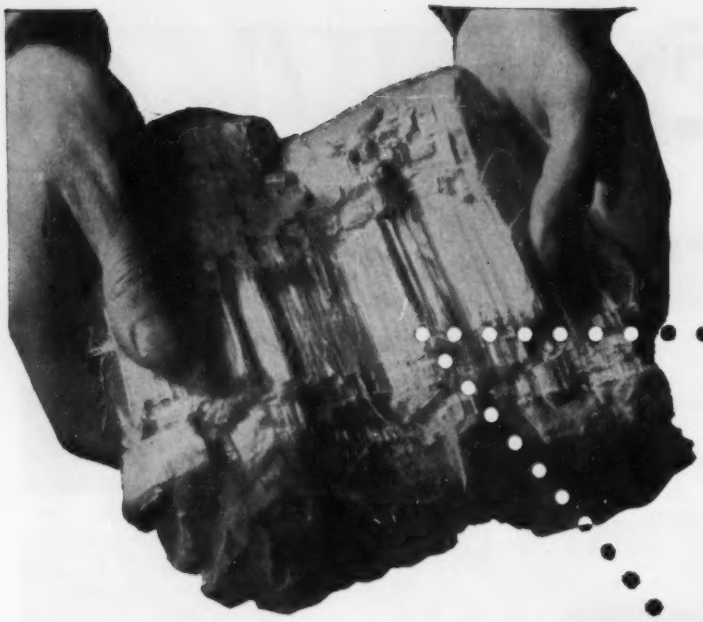
Panoramic view of part of conveyor belt system utilizing U. S. Giant Conveyor Belting in power plant on the Delaware River.

To feed the four boilers in this power plant in the Delaware Valley, United States Rubber Company conveyor belts, capable of handling 300 tons of coal an hour, take the coal from hopper cars to breaker house to coal bunkers. Like so many other successful belting installations, this one is the result of United States Rubber Company's "Three-Way Engineering" —in which "U. S." engineers work with the engineers of the conveyor system and the power company engineers to turn out the most durable, economical belt system for the specific job. In America and abroad there are thousands of "Three-Way Engineered" jobs, some large, some small —but all steadily keeping output high, costs low. Get in touch with any of the 27 "U. S." District Sales Offices, or write to us at Rockefeller Center, New York 20, N. Y.

US RUBBER

Mechanical Goods Division

United States Rubber



From the magic mineral

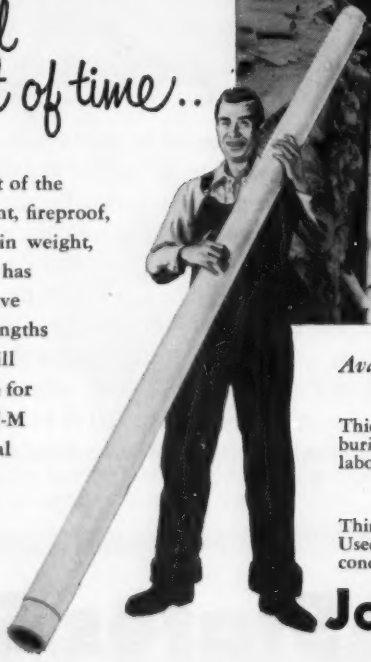
...ASBESTOS

come these strong, durable

TRANSITE DUCTS

made to stand the test of time..

Transite* meets every requirement of the ideal duct material. It is permanent, fireproof, corrosion resistant, strong, light in weight, smooth-bored, non-inductive, and has rapid heat dissipation. No protective coating is required. The 10-foot lengths are rapidly assembled. Transite will outlast other duct materials. Write for new, free brochure showing how J-M Transite Ducts can effect substantial savings in both installation and maintenance of cable subways. Address Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ontario.



Available In Two Types:

TRANSITE CONDUIT

Thick walled, used for exposed work, or buried without concrete casement saves time, labor, materials.

TRANSITE KORDUCT

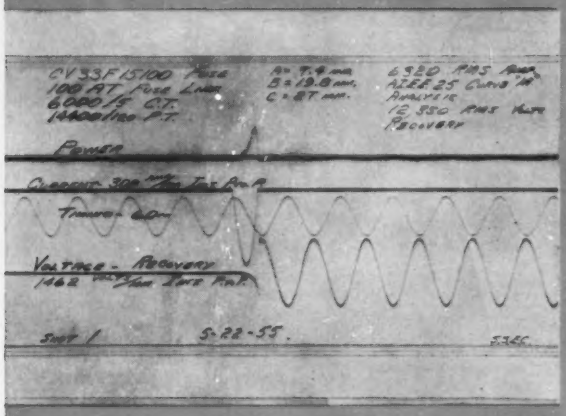
Thinner walled for installation in concrete. Used for high-voltage lines, its high thermal conductivity cuts operating losses.

JOHNS-MANVILLE JM PRODUCTS

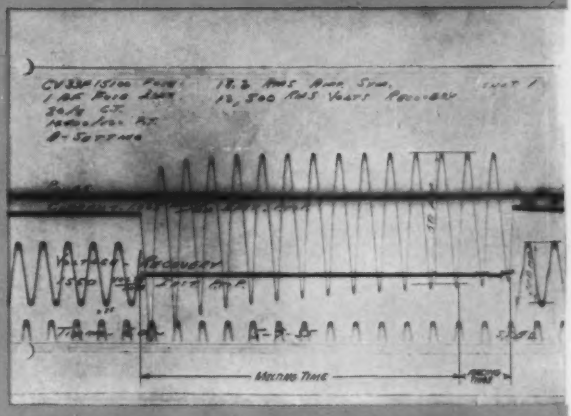
Johns-Manville

*Trade mark registered

high faults or low faults



HIGH CURRENT TEST In this test the cutout was subjected to a fault of 6320 amperes at a power factor of 19.6%. Arcing time was less than a half cycle. This test was conducted at Georgia Power Company's North Columbus Substation.



LOW CURRENT TEST In this particular low current test, the cutout was subjected to a fault of 18.2 amperes at a power factor of 15.9%. The circuit was cleared after two cycles of arcing time. This test was conducted at Southern States test facilities.

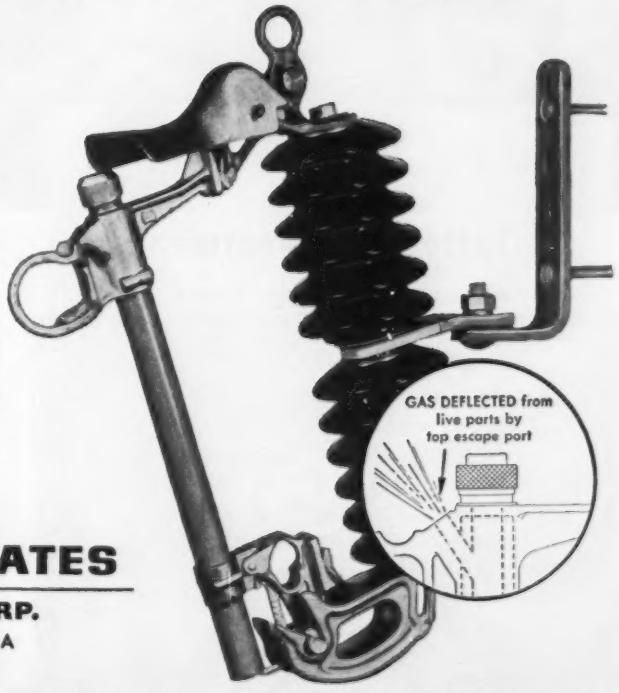
SOUTHERN STATES' CV-33-F TAKES EITHER IN STRIDE

Engineers responsible for system protection often stress the importance of a cutout's ability to clear an overload condition as well as to interrupt maximum faults.

The Southern States Type CV-33-F is designed to give the best possible operation at both extremes.

During its development, Southern States' engineers repeatedly subjected it to both high and low faults. The versatility of the Type CV-33-F Cutout was demonstrated on test after test. Shown above are unretouched photos of oscillograms of two typical tests.

To provide your system with dependable wide-range protection, choose the Southern States Type CV-33-F Cutout.



SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA:
Dominion Cutout Co., Ltd., Toronto

OPTIMUM INVESTMENT*
Power Transformers

*Optimum Investment

General Electric's assurance of lower long-term cost, plus greater dividends from your power transformer investment, through:

- **LOW ENGINEERING COST:** G-E field services reduce your engineering expense.
- **LOW PURCHASE COST:** Skill to produce optimum design for each application.
- **LOW INSTALLATION COST:** Upright shipment, one-piece tank speeds handling.
- **LOW OPERATING COST:** Constant characteristics for lasting economy.
- **LOW MAINTENANCE COST:** Product improvements and few failures reduce outages.

VAPOR-PHASE DRYING drives moisture from core-and-coil assembly before tanking. Hot oil vapor in high vacuum dries organic parts, preventing later oil contamination in service. Tightness maintains short-circuit strength.

LOCKING METHODS are special—only four are used. None depend on a cutting or shaving action that chips off metallic shavings. Insulation strength is not impaired by razor-sharp particles. Locking strip, shown above, is one method used.

How much are you paying for aging power transformer characteristics?

General Electric uses the special care necessary to help prevent losses and other characteristics from changing

Power transformers could age. Lightning and surge voltages, system fault currents, years of operating at varying temperatures, pick at the insides of a transformer. Parts could shrink. Braces and clamps could loosen. Then turn-to-turn, layer-to-layer, even lamination shifting (the latter causing interlaminar insulation wearing) could occur. Not readily apparent, this deterioration could reduce impulse and short-circuit strengths, increase core loss, exciting current, noise. Once started, the degeneration tends to be cumulative.

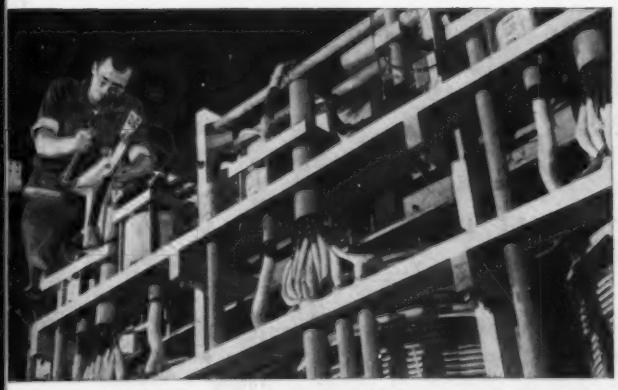
The result of deterioration is higher costs from increased losses and lowered failure resistance. Hence, care must be taken, extra care, to resist costly deterioration. General Electric power transformers have been redesigned, are built with special care to help keep characteristics at their original optimum values. Four examples of this care are: vapor phase drying, the patented process for removing moisture; the stress-resistant braces and clamps; the highly-compressed spacers; and the meticulous attention to locking of studs and bolts.

These are examples of features designed to give you economical operation. There are more. And, combined with other features that give low purchase, installation, maintenance, and engineering costs, they make your General Electric Power Transformer an *Optimum Investment.* General Electric, Schenectady 5, N.Y.

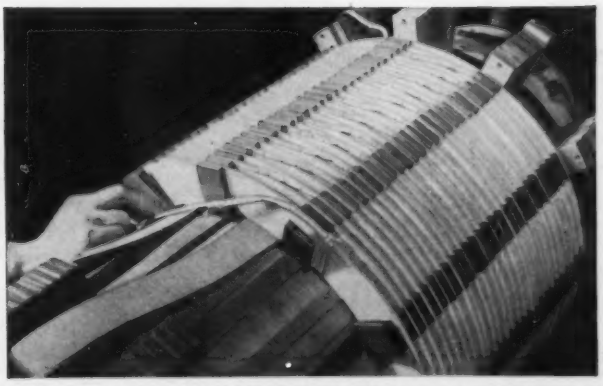
421-43

Progress Is Our Most Important Product

GENERAL ELECTRIC



ASSEMBLY BRACING gives positive pressure for spring-like rigidity. Stress-free clamping holds down core loss, retards abrasive rubbing of laminations. Full strength and low losses are maintained by clamping system.



KEYED WINDING SPACERS, of extra-dense pressboard, are pre-compressed at 24,000 p.s.i. After vapor-phase process removes moisture, adjustable clamps re-compress coil stacks. Spacers don't shrink, loosen, or slip out in service. Coils remain rigid and strong.

Standard® TRANSFORMERS

in good company

Standard Transformers have a reputation for keeping company in the best circles, both here and abroad. Standard designs and builds many of its transformers to meet specific requirements, incorporating those components specifically requested by the customer. These custom transformers cost no more than repetitive models and in many cases, because they are custom built, cut costs all the way along the line.

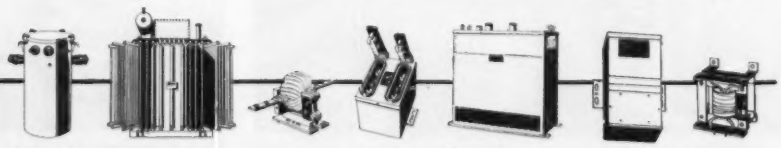
When you ask for bids, or when you place your next order for transformers, include Standard. You'll be following the lead of many outstanding power companies. If you have a specific transformer engineering problem, refer it to Standard. It will receive prompt attention.

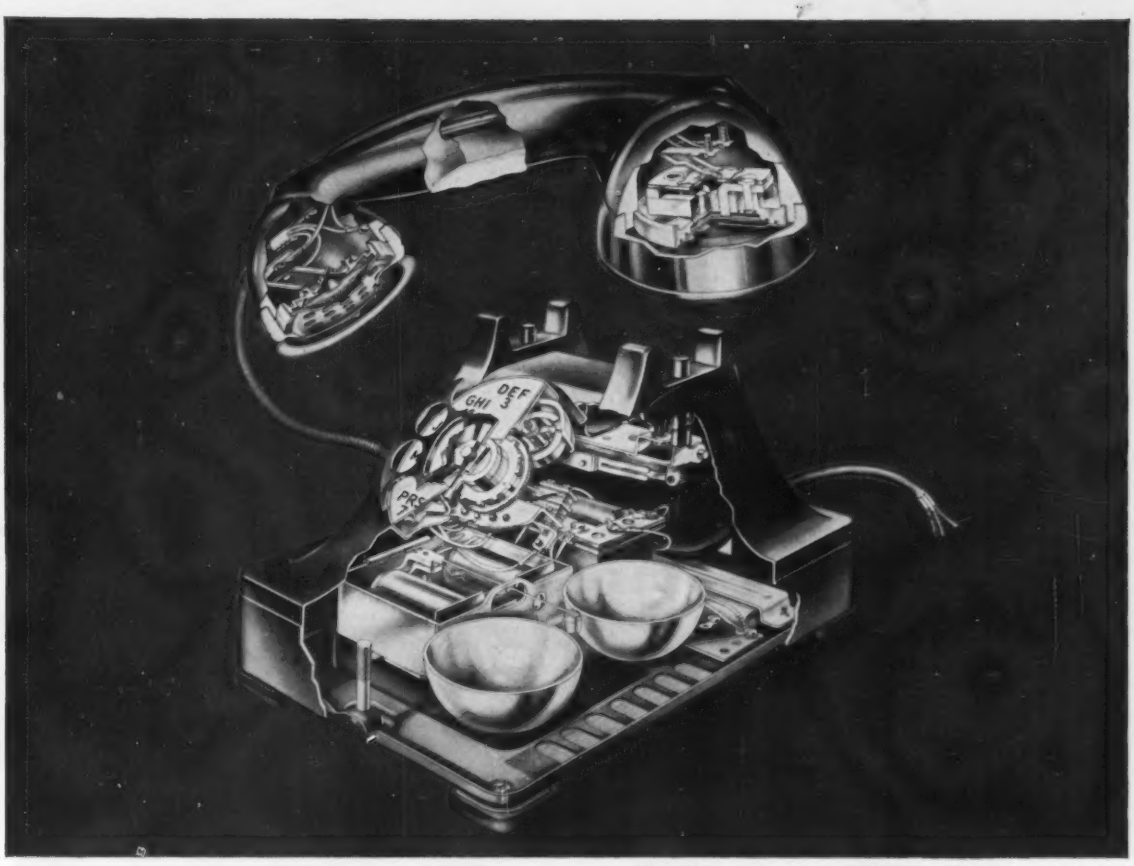
Standard®

THE STANDARD TRANSFORMER COMPANY

WARREN, OHIO • REPRESENTATIVES IN PRINCIPAL CITIES

Transformers FOR EVERY APPLICATION





In critical places your telephone uses COPPER . . . for space-saving, for high electrical conductivity and ease of joining, for dependable performance.

COPPER
speaks for itself!

Everyone who uses copper learns something from it . . . something no substitute can teach.

To the man who machines or stamps or draws metals, copper and its alloys speak of easy workability.

To the firm that uses copper parts instead of substitutes, copper tells the story of satisfaction . . . of standing up in service.

To the designer of complicated equipment, copper offers savings in valuable space . . . permits "miniaturization".

And to the home-owner wise enough to install copper throughout his "castle", time itself tells an unending tale of trouble-free enjoyment.

Copper will speak for your product, too. It will signify *quality!*

It costs you less to make your product well, before it is sold . . . than to make it good, afterwards.

COPPER & BRASS
RESEARCH ASSOCIATION
420 Lexington Avenue, New York 17, N. Y.

. . . AN INDUSTRY SOURCE OF TECHNOLOGICAL AID, INCLUDING A LIBRARY OF TECHNICAL LITERATURE AND A COUNCIL OF SPECIALISTS

COPPER OR ITS ALLOYS PROVIDE THESE ADVANTAGES:

Best conductor of electricity commercially available

Does not rust . . . high corrosion resistance

Best heat transfer agent of all commercial metals

Easy to machine, form, draw, stamp, polish, plate, etc.

Welds readily . . . excellent for soldering and brazing

This trolley design lowered first costs 30%

This is the 235 ton Powerhouse Gantry Crane built by Paceco for Pacific Power & Light Co., Ebasco Services, Inc., engineers.

Paceco's single trolley design for cranes over 150 ton capacity reduced initial cost 30%-40% below double trolley designs using lifting beam.

Besides economical first cost, the crane has proved low maintenance record. These are Paceco's standards for *every* crane we build. This is why Paceco "tailors" each crane to maximum advantage to the *owner!*

May we harness our nationwide experience-built skills to serve you? We invite your inquiry.

Besides cranes of all types, Paceco designs and builds hoists, high pressure gates and valves; intake gates. May we send you our illustrated brochure on all these products?

PACIFIC COAST ENGINEERING COMPANY

ENGINEERS • MACHINISTS • FABRICATORS

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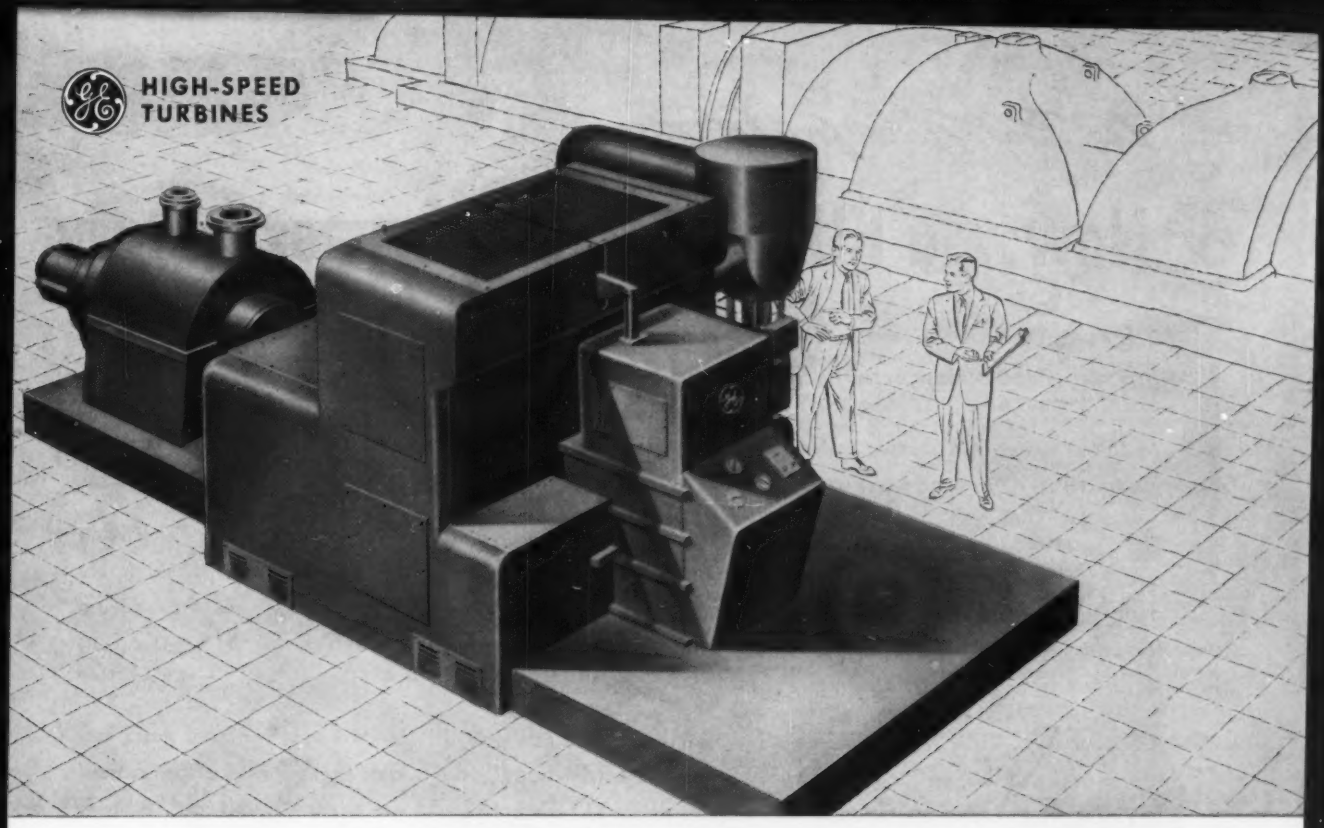
PACECO

"TAILORS OF STEEL"®



With G.E.'s new turbine drives for boiler feed pumps . . .

Up to 40% of auxiliary electrical power can now be released as salable kilowatts

In today's larger-capacity, high-pressure steam stations, motor drives for boiler feed pumps require as much as 10,000 hp—a heavy drain of auxiliary electrical power. To release this power as salable kilowatts, General Electric now offers a new line of high-speed turbines—specifically designed for 4000 to 10,000 hp boiler feed pump service.

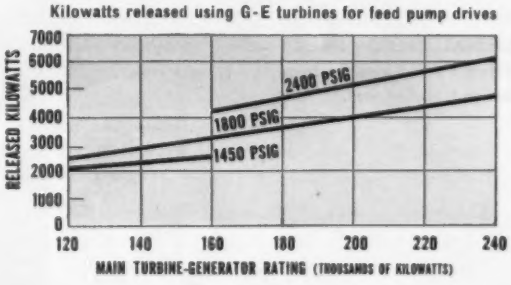
Savings in auxiliary electrical power can be as high as 40% with the application of these G-E turbines. Auxiliary system voltage can often be reduced from 4160 to 2400 volts, with considerable savings through lower transformer and circuit breaker ratings.

G-E turbines provide direct drives at speeds up to 9000 rpm. At half load or above, the variable-speed turbines can also improve net station heat rate by eliminating transmission losses and throttling losses across feed valves.

Over the past 25 years several utilities have operated G-E turbines in boiler feed applications. More recently, the development of economical high-speed pumps for large-capacity boiler feed service has broadened the range of applications for turbine drives.

If you are now contemplating system capacity increases of 100,000 kw or more, be sure to ask your Apparatus Sales Representative about G-E High-speed Turbines for boiler feed applications. Or write to General Electric Company, Section 241-6, Fitchburg, Mass.

Kilowatts released using G-E turbines for feed pump drives



Progress Is Our Most Important Product

GENERAL ELECTRIC

The Big News for '56

Now...a KUHLMAN transformer factory

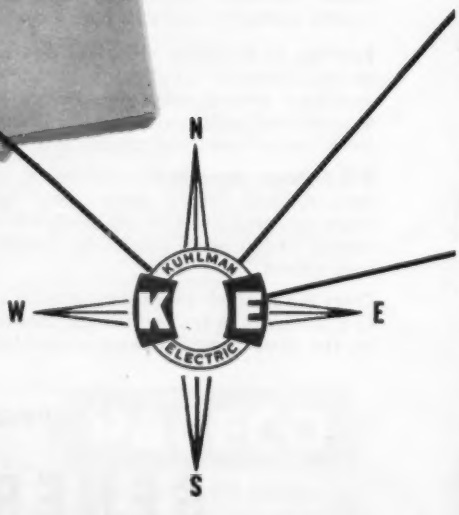
Each Factory Can Better Solve Your Transformer Problems With Efficient Regional Production Scheduling, Warehousing and Servicing.

You'll get faster transformer deliveries—improved regional manufacturing and warehousing—more personal factory-to-customer service from the newly expanded KUHLMAN factory in your area.

This expansion of regional service and manufacturing is the result of a growing preference for KUHLMAN quality by many of the country's leading utilities. In fact, customer acceptance has approximately doubled KUHLMAN'S factory floor space in the last four years. Today, three independent producing factories—like the one in your area and 31 finished product distribution centers with 51 sales offices stand ready to serve you nationally—and by regions.

Ask your local KUHLMAN representative exactly how he can put KUHLMAN'S new regional manufacturing and distribution facilities to work for you. He'll be happy to explain, and with all of us, extend to you a most cordial invitation to visit your regional KUHLMAN plant for a friendly plant tour.

SALINAS, CALIFORNIA . . . serving the eleven Western states is one of the nation's most modern transformer factories, producing a full line of distribution transformers.



in your area

BAY CITY, MICHIGAN . . . located in the heart of the industrialized Middle West and Northeastern United States, this KUHLMAN factory has a 62 year old record of service to industry.

CRYSTAL SPRINGS, MISSISSIPPI . . . both serving and contributing to the development of diversified Southern industry, this KUHLMAN factory produces a complete line of power and distribution transformers.

KUHLMAN ELECTRIC COMPANY

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA

New FW Homogeneous Reactor

for LOW-COST ATOMIC POWER

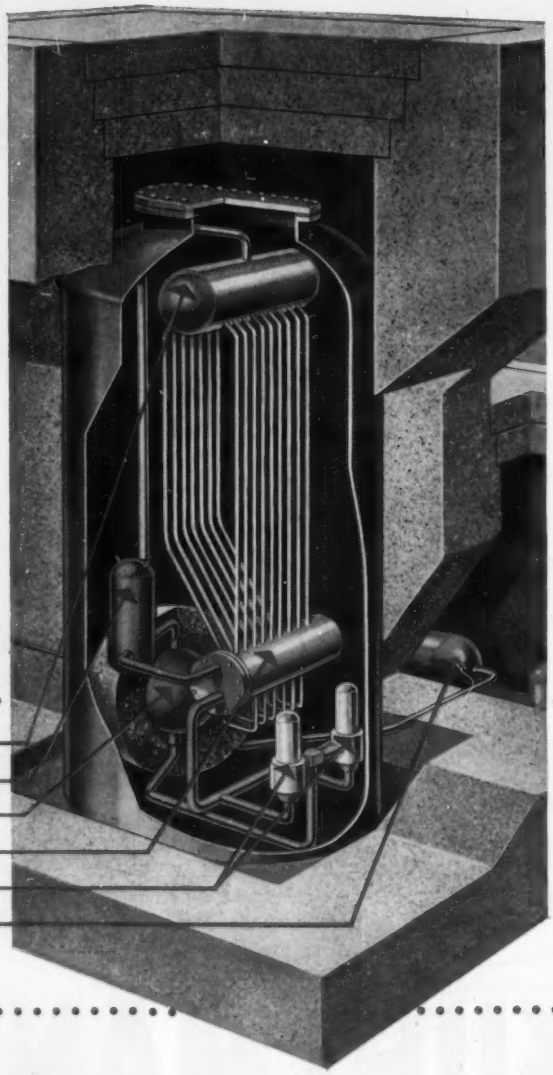
in the 5,000 to 40,000 kw output range

Simplicity of design, exceptional stability and ease of control are outstanding features of this small homogeneous power plant

The one-region aqueous homogeneous reactor illustrated in the cut-away drawing at the right has been designed by Foster Wheeler for economical production of electric power in the 5,000 to 40,000 kw range. It offers these unique advantages.

1. Reactor design is based on optimum nuclear parameters rather than heat removal.
2. Continuous chemical purification of the liquid reactor fuel removes fission and corrosion products.
3. No control or safety rods are necessary. Large negative temperature coefficient of reactivity enables reactor power to follow load demands rapidly and faithfully.
4. Reactor vessel is a simple, spherical pressure vessel.

Liquid fuel is pumped from the reactor to a heat exchanger and the steam thus generated can be superheated and used to drive a conventional turbo-generator. For more complete information, send for a copy of the November issue of Heat Engineering. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*



(HOT portions of circuit shown in red)

FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

Keystone Aluminum Conductor System Installed at Penna. R.R. Shops

ASSURE 7 WAY SAVING IN WEIGHT...POWER...LABOR

THIS IS AN immense project—the new car repair shop of the Pennsylvania Railroad. The shop is 2760 ft. long; 15 overhead cranes are required with capacities up to 25 tons. To furnish electrical connections for the cranes two 3-rail Keystone Aluminum Conductor Systems, each running the full length of the shop, were specified and installed.

Keystone was judged best qualified to meet the rigid conditions required of this installation. It was selected because it would . . .

SAVE TRANSFORMERS—Three installations needed with steel conductors are eliminated with Keystone Aluminum Conductor System.

SAVE FEEDER RUNS—With this non-magnetic system, all but the center tap is eliminated.

SAVE BOOSTER CABLES—System capacity permits satisfactory operation ¼-mile from feeder without boosters.

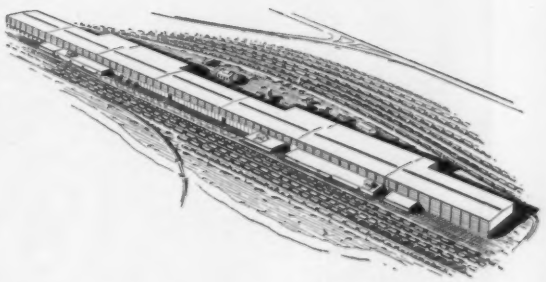
SAVE CAPACITY—Compact design permits close conductor spacings, minimizing impedence drop, reducing conductor size.

SAVE ENGINEERING COSTS—Integrated package design, factory assistance reduce time and effort.

SAVE INSTALLATION COSTS—Lightweight components, factory prefabrication, foolproof design cut erection time and cost.

SAVE OPERATING COSTS—Adequate voltage supply assures maximum crane operating speeds, reduces motor overloads. Protected contact surfaces eliminates shutdowns on exposed systems.

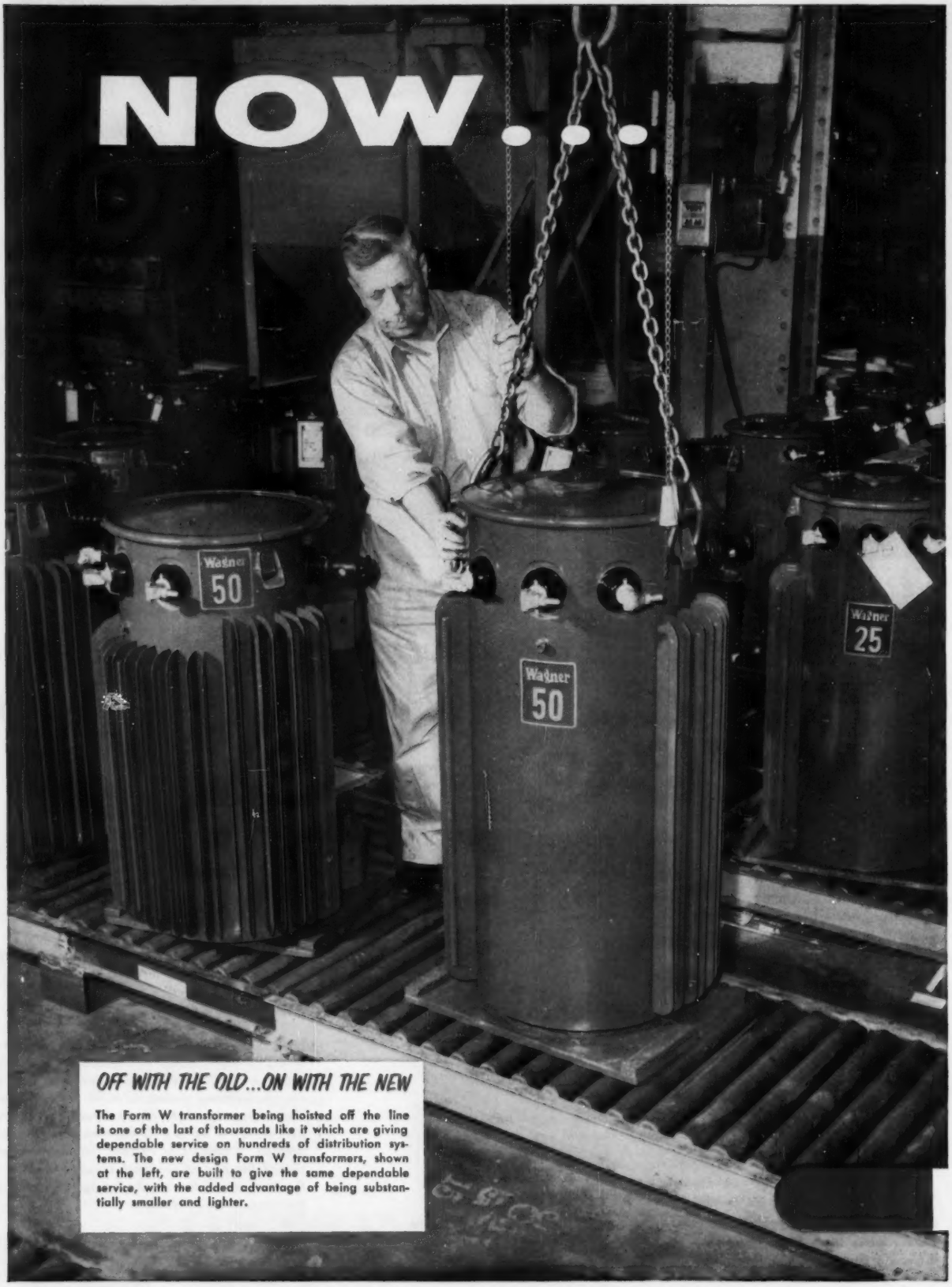
Keystone Aluminum Systems are now operating countrywide on AC and DC runways from 50 to 2760 ft. long, and on ore bridges and unloaders. Standard components range from 500 to 1000, 2000, 3000 and 6000 amp. capacity. Write today for case histories—*"Solving Conductor Problems."*



NEW SAMUEL REA SHOP at Hollidaysburg, Pa. where 50 steel hopper and gondola cars will be rebuilt each day. Large photo above shows 5 of the 15 overhead cranes, 2760-ft. runway; insert shows close-up of Keystone three-rail collector assembly. The Harry F. Ortlip Company of Philadelphia, specialists in railroad engineering and one of the largest electrical construction firms in the East, made the installation for Pennsylvania Railroad.

ELECTRIC SERVICE MANUFACTURING CO., PHILADELPHIA 32, PA.

KEYSTONE



OFF WITH THE OLD...ON WITH THE NEW

The Form W transformer being hoisted off the line is one of the last of thousands like it which are giving dependable service on hundreds of distribution systems. The new design Form W transformers, shown at the left, are built to give the same dependable service, with the added advantage of being substantially smaller and lighter.

Wagner Form W Transformers are up to 17% lighter... 18% shorter

Even before the newest trend to lighter, shorter transformers, Wagner's famous Form W construction made it possible for Wagner to build small-size, light-weight distribution transformers. Now, Wagner engineers have redesigned Form W transformers in ratings 15 through 167 Kva, 15 KV and below, with improvements in core and coil construction that make possible reductions up to 17% in weight and 18% in the important overall height dimension.

For example, the old design 50 Kva transformer shown at the left weighs 895 pounds and measures 45 inches in height; the new 50 Kva transformers, also shown, are 145 pounds lighter and 5 inches shorter.

When you specify these new Wagner transformers, you can save money by putting greater transformer capacity on your existing structures. All ratings through 167 Kva can be pole mounted.

IMPROVED INSULATION A special resin coated insulating material is used for layer, channel and barrier insulation. After heat treating, the resin varnish bonds the coil conductors and insulation together to give the coils exceptionally high mechanical and electrical strength.

MECHANICAL FEATURES In the 25, 37½ and 50 Kva ratings, cooling fins increase the radiating surface. The 75, 100 and 167 ratings are provided with tubes.

The rating of each of these new transformers is clearly shown on the tank.

There are fewer sharp edges and brackets on the tank where rust can start . . . lifting lugs are curved and rounded.

These new, lighter, shorter Form W Wagner transformers will meet your requirements. Full detail are yours in Bulletin TU-180.

SHUR-SEAL CLAMPING RING

Keeps transformer sealed air-tight . . . no atmospheric moisture or dust particles can get inside.

HIGH VOLTAGE SIDEWALL BUSHING

For use with either copper or aluminum conductor . . . safety-designed for faster, easier connections, without tools. Porcelain and terminal are locked in position.

INHIBITED OIL—reduces oxidation to a minimum . . . retards formation of acids and sludge.

LOCKED LOW VOLTAGE BUSHING

The bushing and terminal are key-locked to prevent rotation . . . no loose terminal connections to cause internal shorts. Suitable for copper or aluminum conductor.

Wagner Electric Corporation EST. WE 1891

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave. • St. Louis 14, Mo., U. S. A.

TSE-1

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

Another reason why
UTILITIES EXPECT MORE FROM **POWERS** *American*

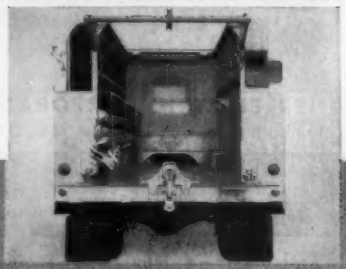
The Ultimate in Line Construction Equipment

SERIES 800-C LINE CONSTRUCTION BODY WITH POLE-MASTER HYDRAULIC DERRICK

MANAGEMENT
likes the 800-C because it saves man-hours—furnishes crew comfort—provides a safe, durable, low-upkeep unit for heavy work.

SUPERVISORS
like the 800-C because it's a completely equipped body that's easy to load—easy to use—easy to inventory.

CREW MEMBERS
like the 800-C because it keeps tools and supplies in easy-to-find order. And, with a Pole-Master, it's a lineman's dream.



All shelves and parts bins are standard equipment. Street-side doors open 180° for easy access to all compartment space.

Sliding drawers are furnished in curb-side compartments. All door locks are keyed alike. Crew enclosure seats four.

56″ wide cargo area provides space for miscellaneous supplies. The body can be equipped to meet individual needs.

Utility operators indicate that the 800-C is destined to set a new standard for line construction vehicles.

It furnishes the storage space—the crew facilities—and the equipment for handling the most rugged types of routine or emergency line work. And, when equipped with a *Pole-Master* fully-powered, live-boom derrick—as shown above—crews can set poles up to 75 ft. in length.

The Series 800-C in 11′, 12′3″, and 13′ lengths—and the Series 800 (without crew enclosure) in 11′ or 12′6″ lengths—can be furnished with *Pole-Master* or conventional derrick.

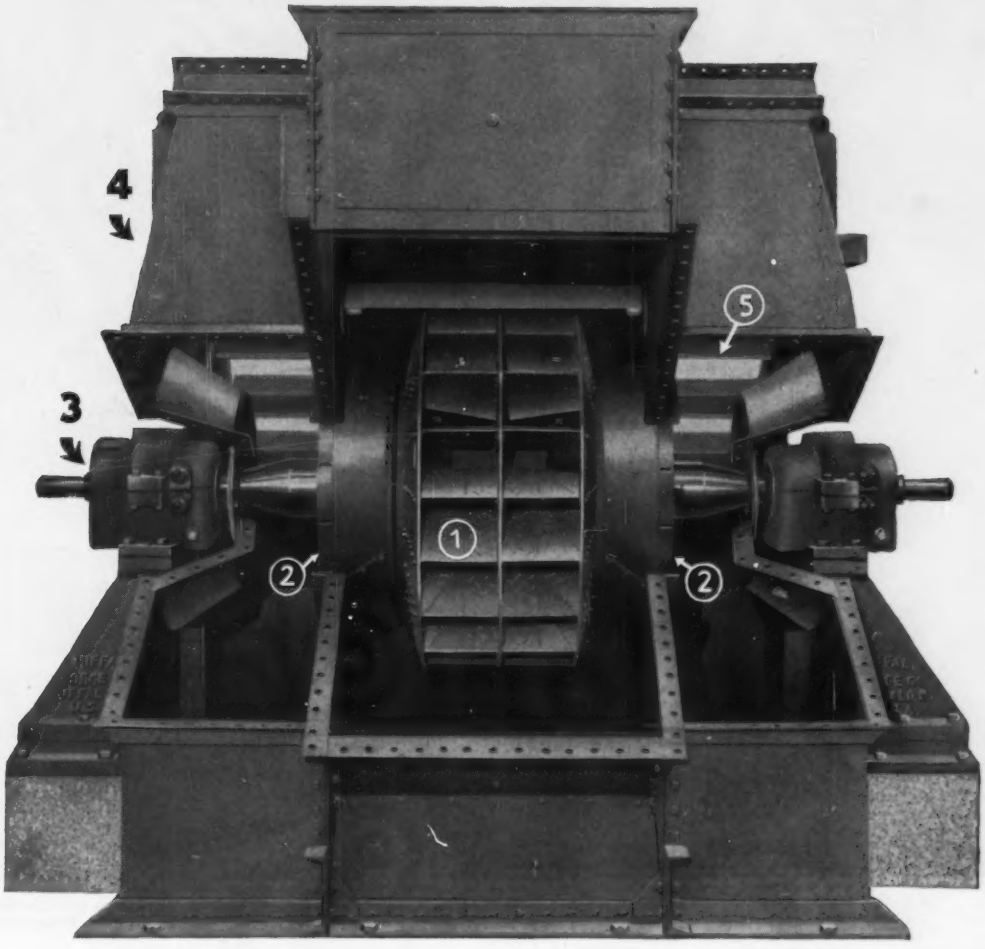
COMPLETE DETAILS and prices are yours for the asking.

Powers-American Division

McCABE-POWERS AUTO BODY COMPANY

3900 NO. BROADWAY • ST. LOUIS 15, MO.

625 CEDAR STREET • BERKELEY 10, CALIF.



BUILT-IN INDUCED DRAFT ECONOMY!

1 "BUFFALO" ROTOR AND BLADES

are heavy plate, welded or hot-riveted for long-lasting strength. Backward-curved blades for best efficiency and least erosion at high operating capacity.

2 "BUFFALO" INLET VANES

for minimum turbulence and entry losses; standard with "Buffalo" Induced Draft Fans. Also available with variable inlet vanes.

3 "BUFFALO" BEARINGS

are self-aligning, reservoir-oiled and water or air cooled; shafts are over-size machined, stress-relieved forgings of high grade steel with solid thrust collars.

4 "BUFFALO" HOUSING

and inlet boxes are bolted sectional design with access doors for simplified cleaning and servicing. Heavy plate, resistant to erosion.

5 "BUFFALO" OUTLET DAMPERS

are available on F.D. or I.D. Fans. Provide parallel air-stream flow for reduced turbulence and smooth control.

●

WRITE FOR BULLETIN 3750

for further engineering data on these "Buffalo" Induced Draft Fans with long-run economy built into them.

"Buffalo"

BUFFALO FORGE COMPANY

BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

Generating capacity of this plant is now 250,000 kw. Output goes into transmission system at 115 kv and 230 kv.

Reliability of Allis-Chalmers Switchgear Is a "Must" at Barry Steam Plant

Unit arrangement of auxiliary switchgear places emphasis on reliability in Alabama Power Company's newest base-load plant

Here's the reason. All station auxiliaries for each generating unit are connected to one bus. This scheme places more than ordinary demands on the Allis-Chalmers auxiliary switchgear in maintaining uninterrupted service because it extends the "unit" principle to the station auxiliary switchgear.

Scheme Saves on Breakers

This arrangement is, of course, economical. Only one incoming breaker is used for each unit. An ingenious scheme of putting a single spare exciter on the tie circuit between two units reduces breaker requirements.

Barry Steam Plant has initial installed capacity of 250,000 kw, with provision for ultimate expansion to 1,000,000 kw.

Starting power for station service auxiliaries is provided by a station service transformer taking power from the 115-kv transmission system. This starting transformer also serves as a backup for the two regular unit station service transformers.

These two transformers are connected to their respective generator buses. They provide power to auxiliaries at 4.16 kv through two lineups of Allis-Chalmers switchgear — each with 22 cubicles.

For Progress in Switchgear

ALLIS-

Transfer Simplified

A manual make-before-break scheme is used to transfer station service load between starting and unit transformers. There is no synchronizing problem, since both starting transformer and generator are connected to same 115-kv bus.

Interlocks are provided to trip out the connected supply breaker when closing the other incoming supply breaker.

Customary interlocks are provided in the switchgear to insure proper sequence of start-up and shut-down of boiler auxiliary motors.

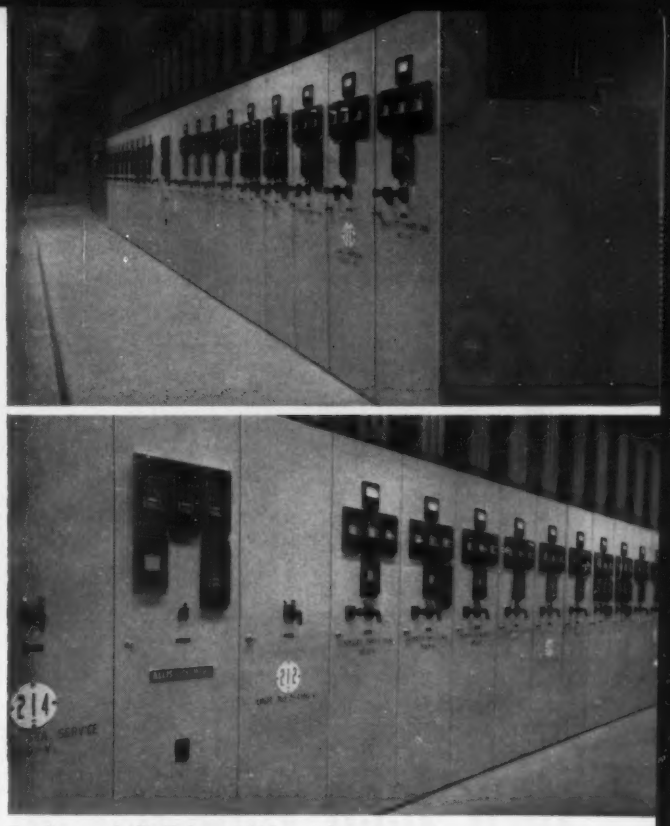
Both overload and short-circuit protection are provided to the switchgear for all feeder circuits.

Power is fed to the switchgear near a midpoint in the bus. Essential auxiliaries are duplicated on each side of the supply point.

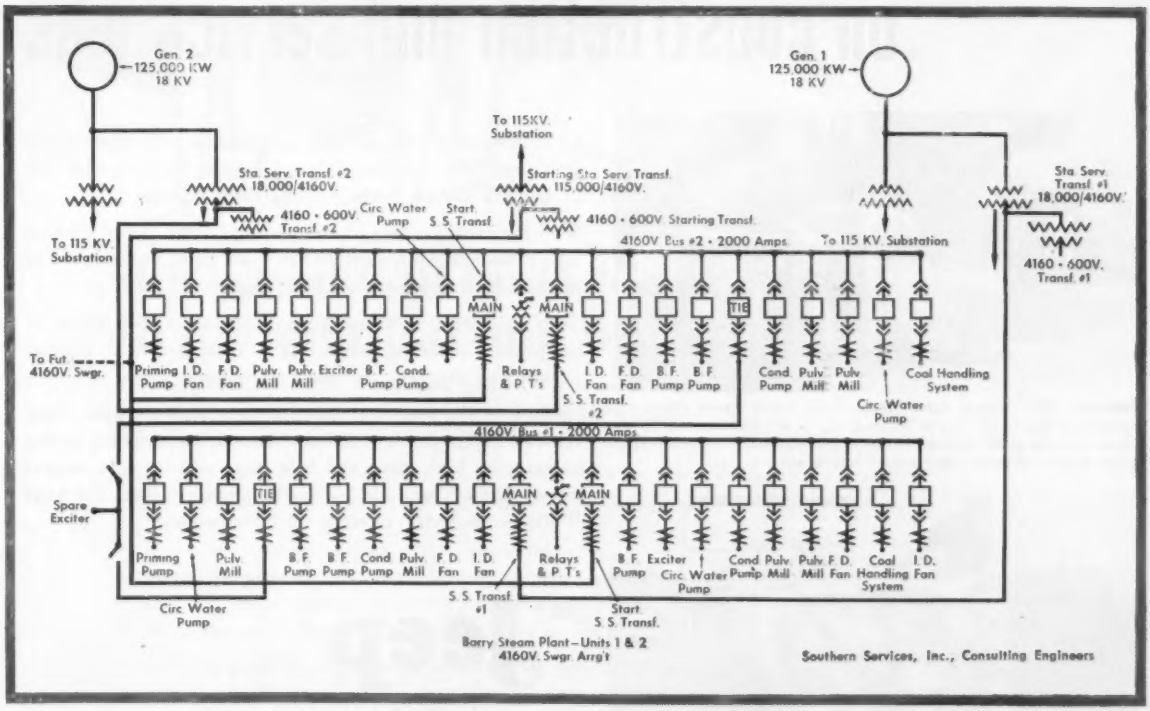
This means sufficient auxiliaries can be connected to carry about half load in an emergency. And it provides more uniform current distribution in the switchgear.

* * *

Allis-Chalmers engineers worked in close cooperation with engineers from Southern Services, Inc. and Alabama Power Company. This is but one of the many auxiliary switchgear installations built by Allis-Chalmers. For more information, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.



Two lineups of Allis-Chalmers 4.16-kv switchgear are used; each lineup has 22 cubicles.



CHALMERS

A-C ALLIS-CHALMERS

A-4959

Line patrol. The Universal 'Jeep' carries patrol and service crews and equipment along the right of way to structures in off-road locations. It travels in conventional 2-wheel drive at highway speeds, but shifts easily into 4-wheel drive for extra traction to go through mud, soft earth, sand or heavy brush—or climb steep grades—where other vehicles can't go.

How 'Jeep' vehicles cut costs on construction and service jobs

Maintenance. The 4-wheel drive 'Jeep' Truck takes repair crews and equipment wherever they're needed, on or off the road. With the extra traction of its 4-wheel drive, it gets through to trouble spots when storms or other emergencies knock out service.

Trenching. The 'Jeep'-propelled trencher digs up to 800 feet of clean-cut 6-ft. deep trench per hour, to speed the installation of cable, conduit and service lines. Unit travels at highway speeds between jobs.

From line installation through maintenance and other service activities... the electrical industry is served on job after job 24 hours a day by 4-wheel drive 'Jeep' vehicles.

With the extra traction of their 4-wheel drive, 'Jeep' vehicles take crews and equipment off the road, right to the tower or substation, wherever service is required.

'Jeep' vehicles with power take-off operate a wide range of equipment, including generators ... compressors ... mowers ... post hole diggers ... winches ... and many more.

Learn how the electrical industry uses multi-purpose 'Jeep' vehicles for hundreds of different jobs, from installing meters to stringing high lines, and how these vehicles save owners money through long life and low maintenance costs. See your Willys dealer today, or write for information.

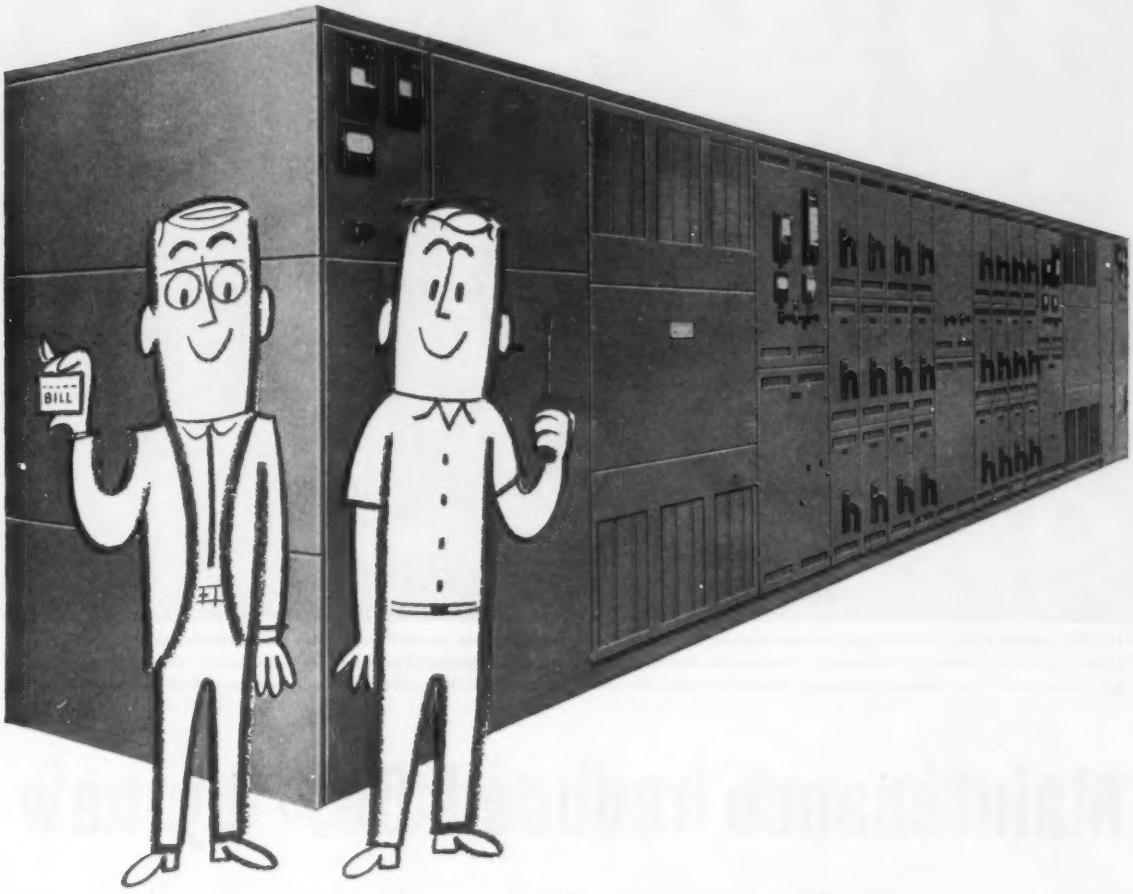
The 'Jeep'®

family of 4-wheel drive vehicles

WILLYS... makers of the world's most useful vehicles

WILLYS MOTORS, INC., TOLEDO 1, OHIO

I-T-E Secondary Unit Substations



. . . designed and built for economy in installation and operation

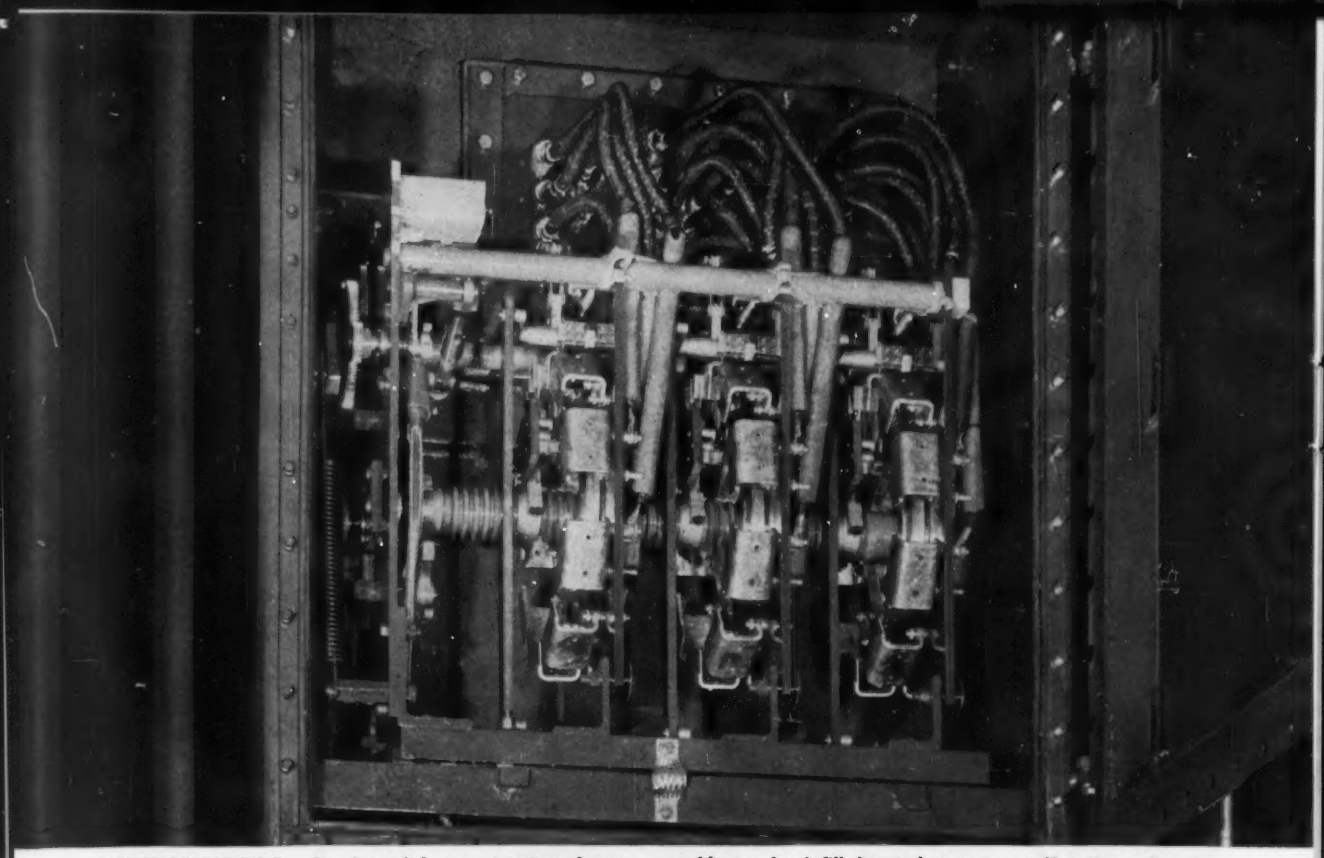
I-T-E Secondary Unit Substations bring electric power nearer to where you use it—make it more dependable—save you time and money.
They do it in several ways:

- By bringing higher voltages nearer the load and reducing power losses
- By reducing voltage drops inherent in long low-voltage runs and increasing machine efficiency
- By saving space—all necessary components are housed in one functionally designed unit
- By cutting delivery and installation time—units are assembled, tested and shipped ready for immediate installation from one source of supply
- By protecting plant personnel—all live parts are isolated and metal enclosed

I-T-E Secondary Unit Substations can be supplied for any application indoor or outdoor, and in any standard rating. For complete information, contact your nearest I-T-E sales office. Or write I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Phila. 30, Pa.

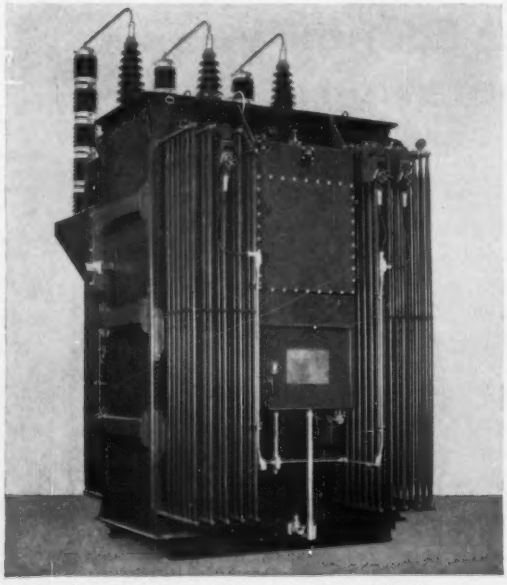
I-T-E

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division



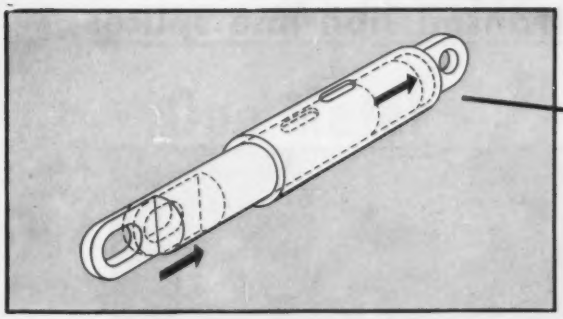
QUIETER OPERATION. Tap-changing switch compartment now houses motor and drive assembly completely immersed in oil to muffle noise and provide permanent lubrication. Formerly, motor plus assembly was in air-filled control compartment. Mounting under oil, and redesigning of geneva gear for smooth driving-pin entry—without impact—has cut peak noise level about 20 db.

Maintenance reduced 50% by new



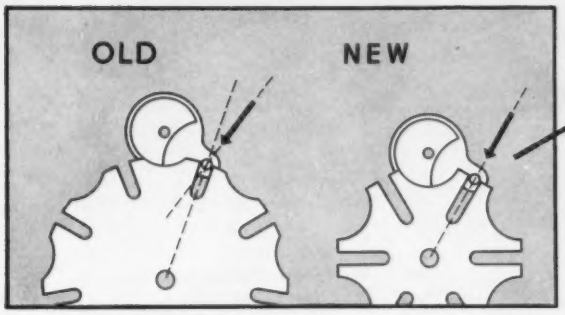
RM MEDIUM TRANSFORMERS employ the new LRT-68 load-tap-changing switch in LTC models.

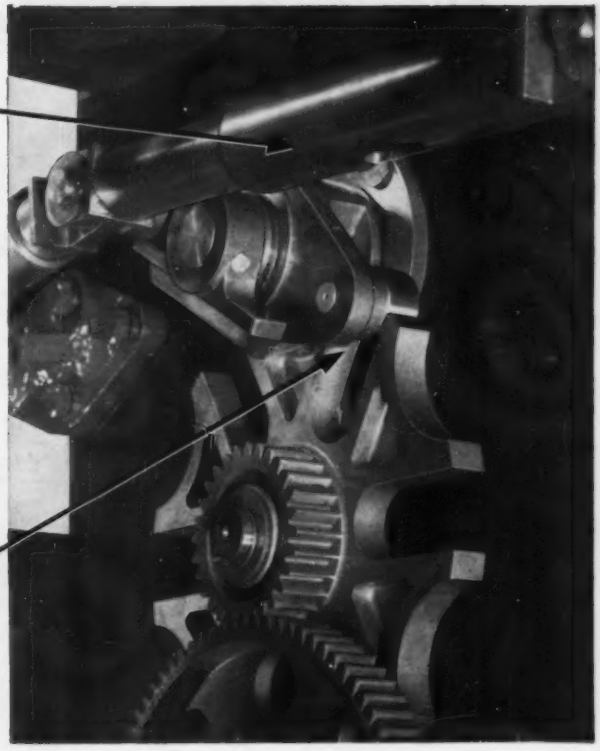
STEP REGULATORS up to 1000 kva will now have the added advantages of the new LRT-68 load-tap-changing switch.



HYDRAULIC DASHPOT

NEW GENEVA GEAR





REDUCED MAINTENANCE. LRT-68 incorporates new hydraulic dashpots and redesigned geneva gear. The two dashpots provide (1) optimum contact separation speed, and (2) reduced engagement velocity, for minimum contact erosion and less secondary arcing.

Geneva gear driving-pin now enters gear slot smoothly, parallel to the side of the slot. Previous design entered at 19° angle. Gentle acceleration and deceleration reduces jarring and mechanical wear. This, plus thicker contact tips, results in 100% increase in tip life.

General Electric load tap changer

Peak operating noise cut 20 db with LRT-68 switch now used on RM transformers and three-phase step regulators

DOUBLED CONTACT LIFE of General Electric's new LRT-68 load-tap-changing switch means routine inspection and maintenance can be *cut in half* on G-E LTC Medium Transformers, and on three-phase step voltage regulators up to 1000 kva.

These savings have been made possible by:
(1) reducing the amount of contact wear per operation, through redesigning the geneva gear (providing smoother operation) and adding hydraulic dashpots (for optimum separation and engagement speeds) and (2) using heavier, thicker contact tips, from which more material can wear before replacement is necessary.

REDUCED OPERATING NOISE results from a complete redesign of G.E.'s load-tap-changer. This means increased consumer good will and less investment in sound-absorbing walls and barriers, when LTC equipment is installed in residential areas.

For full information on this new load-tap-changing mechanism and the medium transformers and three-phase, step voltage regulators on which it will be used, contact your nearest General Electric Apparatus Sales Office, or write Section 416-4, General Electric Company, Schenectady 5, New York.

Progress Is Our Most Important Product

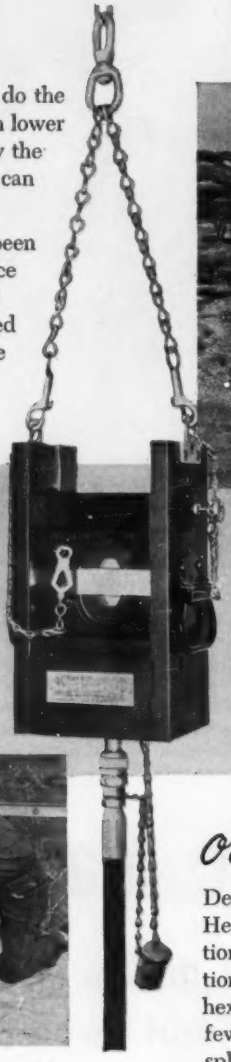
GENERAL ELECTRIC

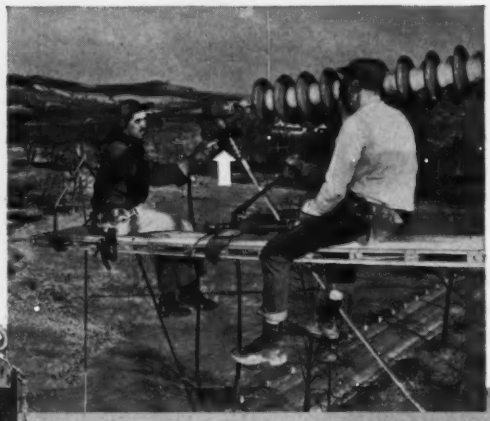
Now *ONE* portable tool makes transmission line splices

OVERHEAD

It's no longer necessary for linemen to do the sagging and marking overhead and then lower the line to the ground for splicing. Now the complete operation, including splicing, can be performed overhead.

T&B's Forty-Ton Hydraulic Head has been specially designed for heavy-duty service in building transmission lines. Since it weighs only 36 pounds, this factory-rigged tool can be put into operation anywhere a man can throw a rope. Safety chains keep all removable parts from falling to the ground.



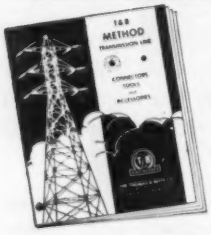


T&B's Forty-Ton Hydraulic Head, Cat. No. 21940, specially designed for transmission line building.

or ON THE GROUND

Demountable legs hold T&B's Forty-Ton Hydraulic Head at convenient working height when installations are being made on the ground. During operation, hardened steel dies compress fitting and cable hexagonally into one homogeneous mass . . . all in a few seconds. The same die set installs tension splicers, dead ends, loop splicers and taps, tees and terminals.

Modern hydraulic design has virtually eliminated the need for maintenance. However, field maintenance is simple and practical. The 21940 Installing Head can be completely disassembled and reassembled in less than one-half hour with these common tools: screw driver, Allen wrench, and mallet.



T&B Bulletin 70 gives a detailed description of the Forty-Ton Hydraulic Head as well as complete lines of T&B connectors, tools, and accessories for transmission line building. Send for FREE copy.

LOOK FOR THIS SIGN —

AUTHORIZED DISTRIBUTOR T&B ENGINEERED

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T-418

THE THOMAS & BETTS CO.

INCORPORATED

14 Butler Street • Elizabeth 1, New Jersey
Thomas & Betts Ltd., Montreal, P.Q., Canada
MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

One Meter for Two Types of Services

DUNCAN TYPE MK

2- or 3-wire singlephase

Two-Wire TODAY

Three-Wire TOMORROW

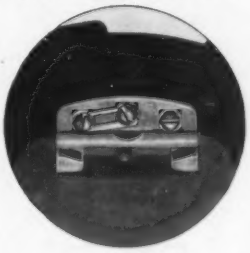
● The Duncan Type MK 15 amp *2-3 wire* meter may be used to meter either a 120-volt *2-wire* or a 240-volt *3-wire* service. This type of meter is particularly applicable where new *2-wire* meters are needed now but would be obsoleted soon as services are changed to *3-wire*.

The MK 15-ampere *2-3 wire* is of the "extended range" type and has full 100 ampere capacity when used on either a *2-* or *3-wire* service. The added capacity of the MK meter keeps it ahead of the expanding use of electric energy.

The meter is quickly converted from one type of service to the other by moving two links—*see illustrations below*. When converted, the calibration may be checked if desired, however the inter-range accuracy is within accepted commercial limits. Close accuracy on either type of service is made possible by a tapped potential coil—the mid-tap designed for 120-volt operation, the full coil for 240-volt operation. To keep the K_h constant the same for either service, one current coil is used for *2-wire* operation and both coils are used for *3-wire* operation (see connection diagram).

Changing Is Simply a Matter of Moving Two Links

For 120-volt



For 240-volt

Potential Link

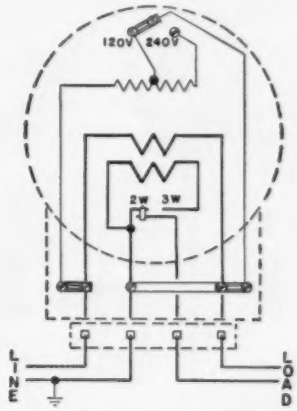
(Above electro-magnet)

For 2-wire

For 3-wire

Current Connector

(Below electro-magnet)



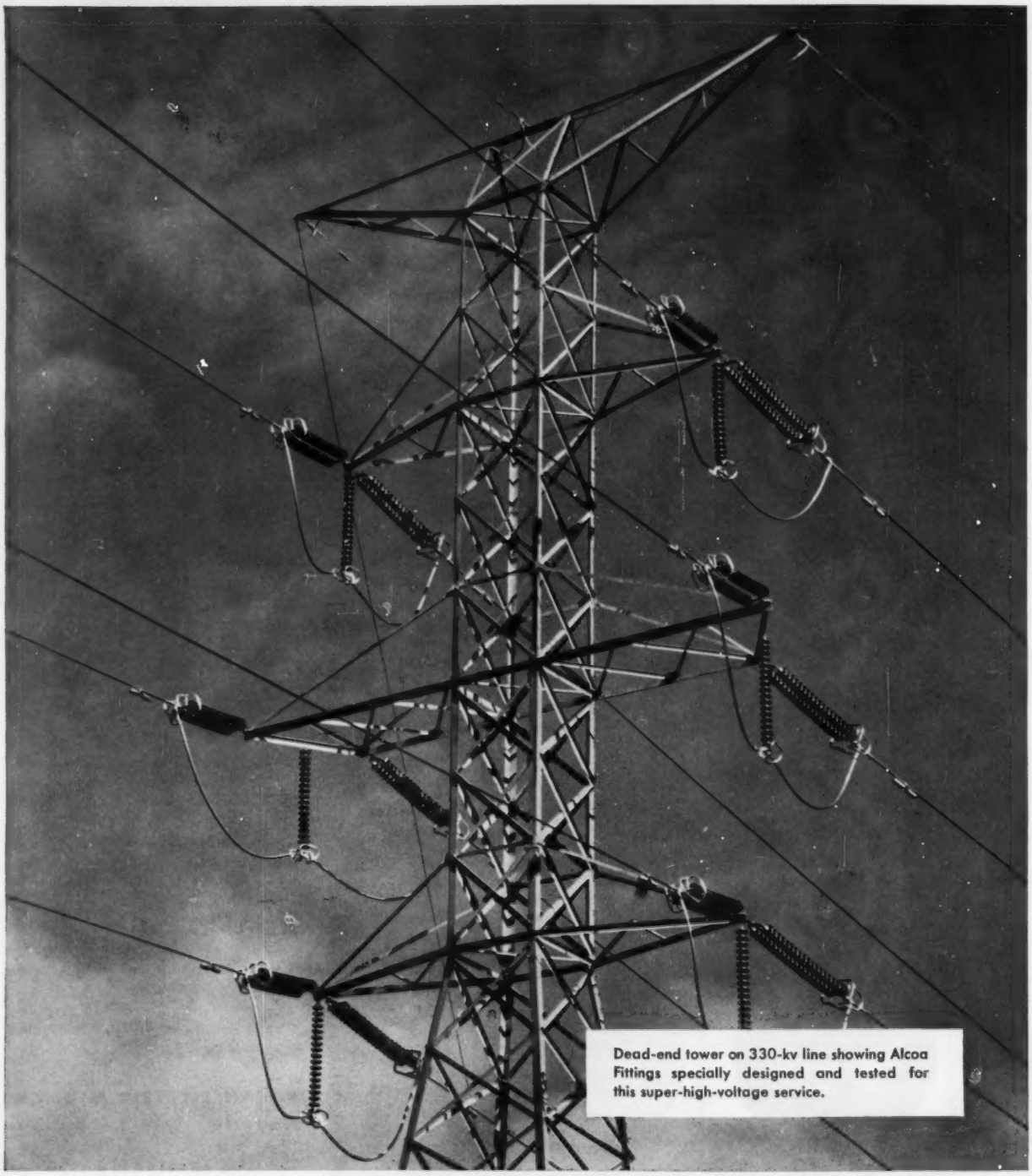
This diagram illustrates typical 2-3 wire connections for MK-A meter. The MK-S is similar. See new Bulletin 185.

This is a Duncan contribution to better, more economical metering.

DUNCAN ELECTRIC MFG. CO.
Lafayette . Indiana

(Advertisement)

330-KV ALCOA EXPANDED ACSR LINES ON OHIO VALLEY ELECTRIC



Dead-end tower on 330-kv line showing Alcoa Fittings specially designed and tested for this super-high-voltage service.

NOW IN SERVICE SYSTEM

Diameter of 1.75 inches and high voltage set new mark for United States overhead conductor

Here the 330-kv line crosses a 138-kv line . . . constructed with Alcoa ACSR more than 30 years ago.

The nearly 400-mile double-circuit lines of the vast Ohio Valley Electric Corporation system, completed in 1955, set new records for United States overhead conductor: the rated voltage is 330-kv and the Alcoa® Expanded ACSR is 1.75 inches in diameter. Similar lines, totaling approximately 330 miles, are in operation on the American Gas and Electric system.

The fundamental research in electrical conductors that made these lines possible was begun by Alcoa more than 30 years ago. Projects in high-voltage aluminum conductors go on continuously in Alcoa's research division. This research division has kept pace with the progress of rapidly increasing loads, requiring larger central stations, higher voltage and bigger conductors. And, when the electrical industry is ready for even larger voltages, Alcoa will be ready with suitable conductors.

The same Alcoa Cable and Accessories, engineering personnel and production facilities that provided these 330-kv transmission lines are always at your service. When *you* have transmission problems calling for special conductor, bring them to Alcoa. No one is better equipped to help you solve them.

Just call your nearest Alcoa sales office. Or write Aluminum Company of America, 2306-D Alcoa Building, Pittsburgh 19, Pa.

Your Guide to the Best in Aluminum Value

ALCOA ALUMINUM
ELECTRICAL CONDUCTORS
ALUMINUM COMPANY OF AMERICA

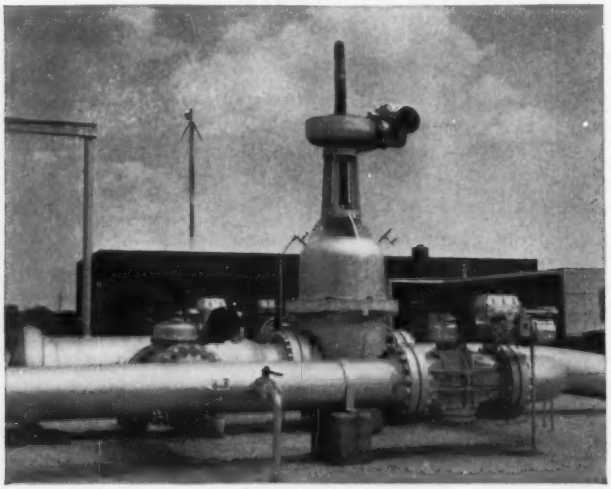
Always Use Aluminum Accessories With Aluminum Conductors

The ALCOA HOUR—Television's finest live drama—Alternate Sunday evenings

MICROWAVE COMMUNICATIONS:

Public Service Company of Indiana, Inc.

Microwave radio aids in controlling supply of electricity for the state of Indiana. Four branches of a G-E Microwave system—combining voice and telemetering channels—originate at utility headquarters in Plainfield. From this hub regional demands are controlled according to local needs. Load control information obtained by remote control telemetering is analyzed, then transmitted to generating stations in necessary areas. Entire electrical power system is linked solidly by microwave radio.



Sinclair Pipe Line Company

Microwave radio helps Sinclair coordinate flow of crude oil and oil products over many states—even turns pumps on and off. 7 voice, 4 telemetering channels link Cushing, Oklahoma and East Chicago, Indiana. Another channel permits remote control of 16 VHF radio base stations along the line which provide communication between over 100 radio-equipped vehicles and any company office in the microwave system. System is capable of providing up to 12 additional channels as needed.

Busy Tower

Antenna receives, transmits, or relays voice or telemetering signals. Antennas like these link headquarters with generating plants and sub-stations over a wide area.

P.S.I.'s microwave network provides utmost dependability because of standby equipment, fail safe feature, and because equipment can be concentrated at specific locations where it can be fully protected and easily maintained.

Are microwave circuits your answer, too?

It depends.

What kind of service do you provide, how do you do it?

Let's assume that instant control and coordination of many functions, over long distances, are vital to your needs. Then you *should* investigate microwave because it is dependable, economical, and inexpensive to add additional circuits.

The services shown here *need* dependable voice and signal circuits. One controls the flow of crude oil and oil products over many states. The other uses microwave to link electric power facilities throughout one state.

Both use G-E Microwave Equipment for efficiency and economy. For additional microwave information, write: *General Electric Co., Microwave Equipment, Sect. X1946-2, Electronics Park, Syracuse, N.Y.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

Want smaller, lighter transformers and oil circuit breakers?

Then **LOCKE'S TYPE U** is the bushing for your apparatus!

FOR 92 KV AND ABOVE

Type U is the high voltage apparatus bushing which gives you all the desirable electrical characteristics of earlier bushing designs PLUS the added advantages of smaller dimensions and lighter weight.

For example, Locke's 161 KV Type U bushing is 6¼" *smaller* in ground sleeve diameter, and 590 lbs. *lighter* than its equivalent of earlier design. There is no sacrifice in dielectric strength.

Specify Type U for your apparatus, and chances are good you'll find that your transformers and oil circuit breakers will come to you accordingly smaller and lighter.

For replacement purposes, Type U is ideal because you can handle it more easily during installation . . . and less storage space is required.

Consult your apparatus manufacturer, or send today for complete descriptive literature.

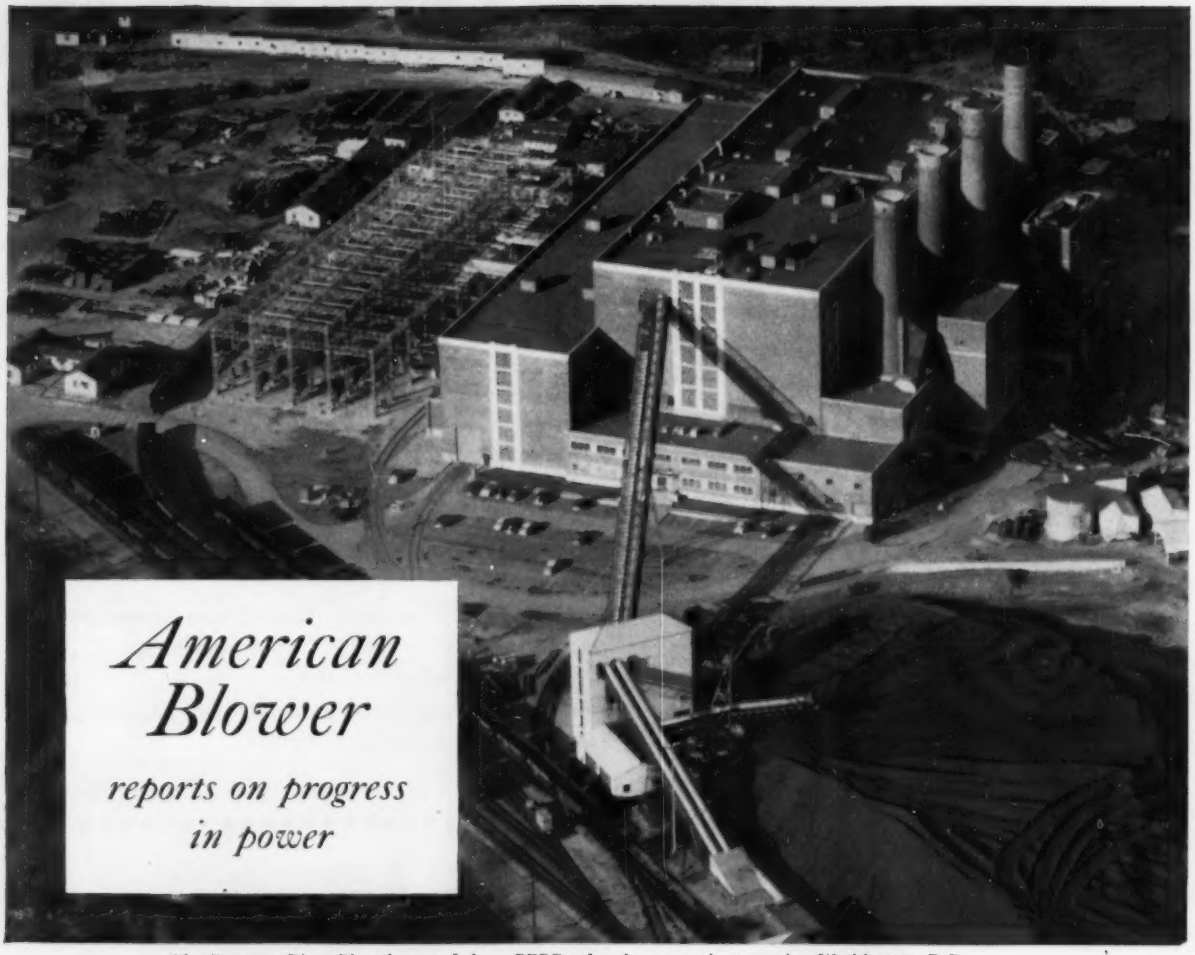
Unusual Radio Noise Test Procedure . . .

Photo shows radio noise test of 287.5 KV Type U bushing. (Today, radio noise is almost zero.) *Each* and *every* Type U bushing is radio noise tested both *before* and *after* one minute ASA standard high potential dry withstand test. This procedure is unusual as the common industry practice is to test on a selected sample basis. Locke makes this and other extra tests to insure uniform bushing reliability.

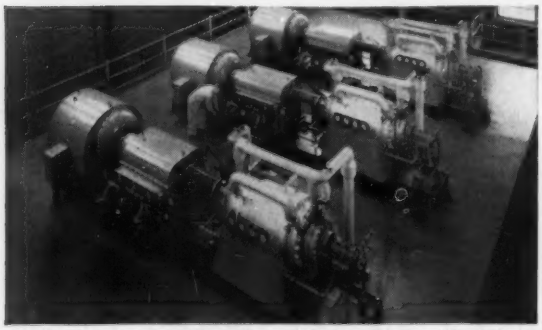
LOCKE

LOCKE DEPARTMENT
GENERAL ELECTRIC COMPANY
BALTIMORE, MARYLAND

Potomac Electric Power



The Potomac River Plant is one of three PEPCo electric-power giants serving Washington, D.C., and nearby areas of Maryland and Virginia.



At PEPCo's Benning Plant, three American Blower Gyrol Fluid Drives provide adjustable-speed control for boiler-feed pumps. Each is rated at 1250 hp at 3600 rpm. Six Gyrol Fluid Drives for the same application are installed at the Potomac River Plant — each is rated at 1750 hp at 3600 rpm.

American Blower Forced Draft Fans are also installed at the Potomac River Station. Fans on Boilers 1 and 2 are rated at 113,000 cfm @ 100°F @ 11.0" sp @ 1150 rpm. Fans on Boilers 3 and 4 are rated at 111,000 cfm @ 100°F @ 17.5" sp @ 700 rpm.

records all-time peak load:

810,000 kw

Potomac Electric Power Company's new high peak load of 810,000 kw in 1955 marked a 9.3% increase above the peak of the previous year. Although it was appreciable, the boost is only the beginning.

The coming years will see the continuation of an expansion program in which Potomac Electric Power Company has been engaged since the close of World War II . . . to better serve its more than 320,000 customers in the District of Columbia, and areas of Maryland and Virginia. During the 14-year period, 1947 to 1960, additions to PEPCo's electric plant are expected to total $320 million.

As an important part of its power build-up, PEPCo relies on American Blower Mechanical Draft Fans for efficient air handling and Gyrol Fluid Drives for smooth power transmission.

Like PEPCo, many other progressive utilities depend on American Blower equipment to meet rigid power-plant demands. Perhaps we can serve *you*, too. Call our nearby branch office for full data on our Mechanical Draft Equipment, Fly Ash Precipitators, Heavy Duty Steam Coils, and Gyrol Fluid Drives for boiler-feed pump and fan control.

American Blower Sirocco Induced Draft Fans service four boilers at the Potomac River station. Latest fans are rated at 160,000 cfm @ 250°F @ 18.0" sp. @ 667 rpm.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN • CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American-Standard

AMERICAN 75th ANNIVERSARY YEAR 1881-1956 **BLOWER**

For Greatest Reliability over

it's PHILCO POWER

10 times more microwave power gives

EXCLUSIVE WITH PHILCO! Ten times more transmitter power in Philco CLR-7 Microwave systems . . . with a degree of performance and reliability never before attained in microwave equipments.

Heart of the Philco system, the "Power House" Klystron, generates a full watt of power (10,000 watts ERP) in the preferred 6000-7500 mc band.

This Philco CLR-7 Microwave power results in a received signal 10 times stronger—a higher safety margin to overcome adverse propagation conditions.

Philco CLR-7 Microwave equipment can be installed in minimum space... employs reliable, long-life tubes, a positive frequency control system and is completely compatible with existing wire line and two-way radio facilities *and with any type multiplex equipment.*

Get complete data on CLR-7 Microwave equipment. Let Philco help in the planning of your system. Philco maintains a staff of microwave specialists who are experienced system and field engineers. Call a Philco field representative or write Philco, Dept. EW, today.

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WASHINGTON 6, D.C.
744 Jackson Place, N.W.

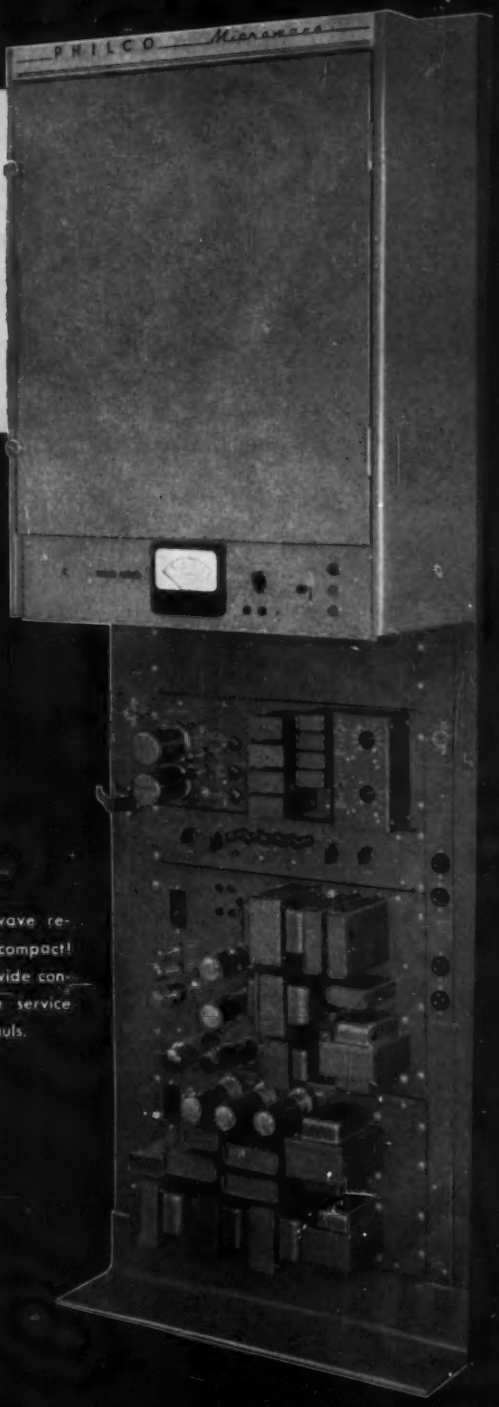
DALLAS 1, TEXAS
201 Southland Life Bldg.

the "Long Haul"

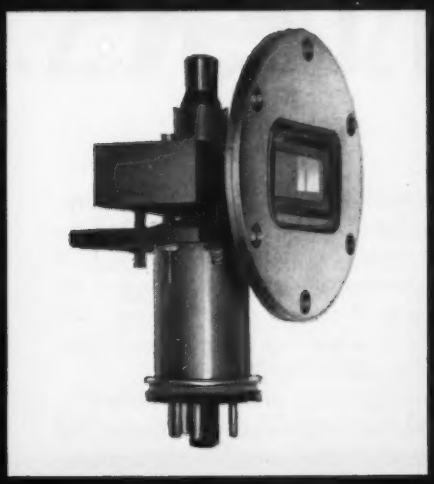
THAT COUNTS!

you advantages like these:

- 160% greater maximum hop distance
- Fewer microwave relay stations
- 10,000 watts effective radiated power—
  50% smaller antennas
- Reduced tower installation costs
- 10 db additional signal safety margin



Philco CLR-7 Microwave repeater . . . rugged! compact! reliable! Built to provide continuous, trouble free service over short or long hauls.



Philco "Power House" Klystron provides the highest equipment power output available in the preferred 6000-7500 megacycle band.

PHILCO CORPORATION

Government and Industrial Division

Philadelphia 44, Pennsylvania

In Canada: Philco Corporation of Canada Ltd., Don Mills, Ontario • In Europe: Philco Corporation, Paris, France.

"... will require
the utmost cooperation
of all of us"

"Our industry has made gigantic strides in the last decade. But, bright as the picture is, there is still a tremendous job to be done. The Live Better Electrically program provides a way to accomplish this job realistically on a national basis. It will require the utmost cooperation of all of us. If we can put this across ... this broad concept of Live Better Electrically ... all segments of our far-flung interests will benefit economically. And, what is more important, the entire nation will be enriched with the opportunity for better living, easier living, happier living."

How electric utility companies are

LIVE BETTER...

Today, over 200 electric utility companies are actively participating in the Live Better Electrically program. On February 8, over 80 of these companies sponsored the Live Better Electrically closed-circuit television show and invited their trade allies in 76 cities to attend. On that afternoon in February, the show was seen by an audience (and a selected audience!) of over 30,000 people.

Two hundred kinescope (film) prints of the show have been distributed for later showings by utility companies, and it is estimated that these will have an audience of a quarter of a million viewers.

Many utility companies are already using the Live Better Electrically theme and symbol in their advertising. Some

Harllee Branch, President, Edison Electric Institute

backing Electrically

have used it on their annual report. Reports have been enthusiastic, and demand for advertising materials has exceeded even the most optimistic plans. Some utility companies have revamped their entire advertising schedule in order to make fuller use of the Live Better Electrically theme. Others have bought time on radio and television to identify their company with the Live Better Electrically movement. The success of the Live Better Electrically campaign depends, in great measure, on co-operative effort. These utility companies working for, and getting the cooperation of, trade allies in their local areas will reap the greatest rewards.

HERE ARE THE WAYS YOU CAN ENLIST THE SUPPORT OF YOUR LOCAL TRADE ALLIES

Conduct regular Live Better Electrically sales and information meetings with dealers, contractors, builders and other local trade allies.

Make wide distribution of all Live Better Electrically promotion materials—banners, window streamers, posters, counter cards and direct-mail pieces.

Suggest truck signs, letterheads, business cards, postage-meter slugs incorporating the theme.

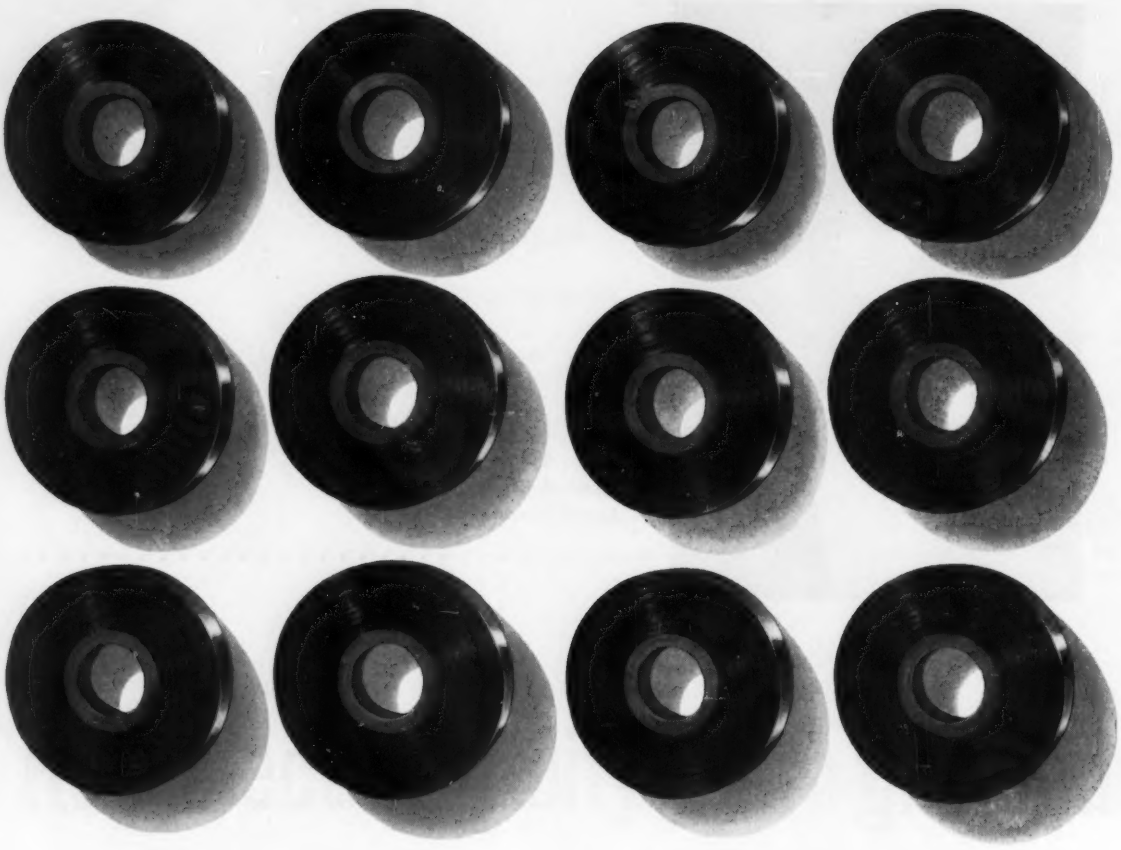
Distribute copies of book "How to Help Home Owners Live Better Electrically" to trade allies.

Supply trade allies with copies of consumer book "Step-by-Step Ideas to help you Live Better Electrically."

Mail copies of 8-page booklet entitled "The Story of Live Better . . . Electrically" to your trade allies.

Use prepared radio and television commercials on your local stations.

Supply your trade allies with prepared newspaper advertising mats in various sizes.



Can you spot a bad roll?

You'd need a pretty sharp eye. Slight variations in tape caliper or in dielectric strength are, like hundreds of other tape properties, pretty hard to see, or to feel.

Yet these tape properties are important — *vitally* important to safe, well insulated wiring — on bus bars, conduit, fittings.

On "SCOTCH" 33, we turn the job over to scientists — to machines and super-sensitive instruments. They perform hundreds of rigid quality-control tests. They make certain that the first plastic electrical tape on the market (and its heavy-duty cousins: "SCOTCH" 21, 22) is still the finest. And they make certain the quality *holds*.

That's why more public utility engineers specify "SCOTCH" 33 than any other plastic tape. They know their men like it — like the way it handles, the way it performs. They know, too, it's the safest way to get exactly* what they want — every time!

**Specifications for "SCOTCH" Brand No. 33 Plastic Electrical Tape: caliper — .007 inch; dielectric strength — 9,500 volts; adhesion (ounces per inch width) — 25; elongation at break — 175%; tensile strength (lbs. per inch width) — 25; More detailed information on request.*

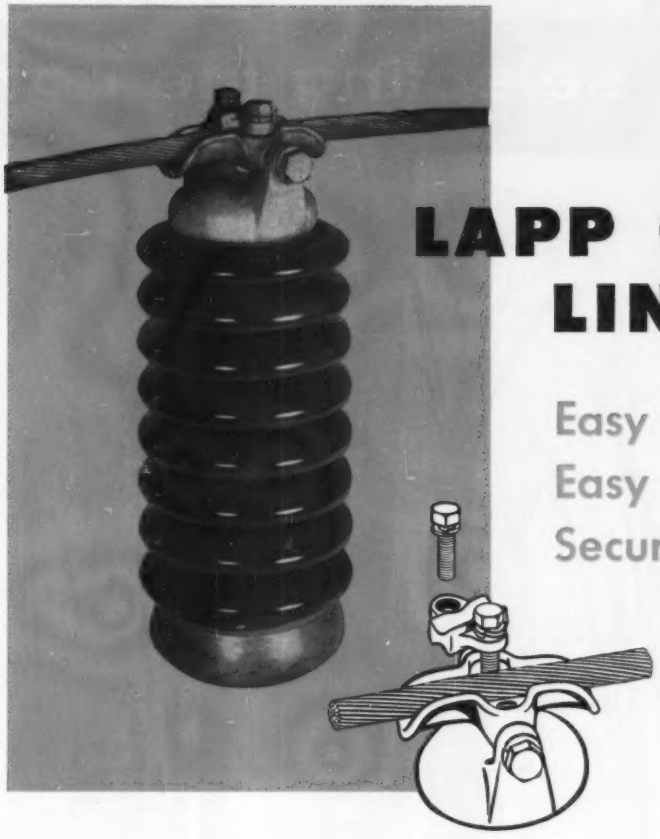
PRODUCT OF 3M RESEARCH

REG. U.S. PAT. OFF.

SCOTCH BRAND No. 33 Electrical Tape

The term "SCOTCH" is a registered trademark of Minnesota Mining & Manufacturing Company, St. Paul 6, Minn. Export Sales Office: 99 Park Avenue, New York 16, N.Y. In Canada: P.O. Box 757, London, Ontario.

3M COMPANY

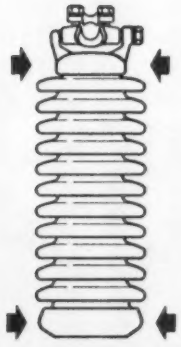


LAPP CLAMP-TOP LINE POST

Easy to install...
Easy to change...
Secure in operation

For original installation, the Lapp Clamp-Top Line Post, with clamp attached, is mounted (stud bolts of any length are interchangeable). Keeper cap screws are loosened, and one removed. Keeper is rotated out of position, conductor dropped in, keeper and cap screw replaced, and both screws tightened. Cap screws have captive washers—there's *only one loose part* per insulator throughout installation.

To change out an insulator, the trunnion screw is backed off (not removed). Clamp stays on the conductor and is slipped back into position in new insulator. All clamps are interchangeable in all sizes of Lapp Clamp-Top Line Posts. Line can be reinsulated for higher voltage with ordinary hot line tools with greatest convenience.



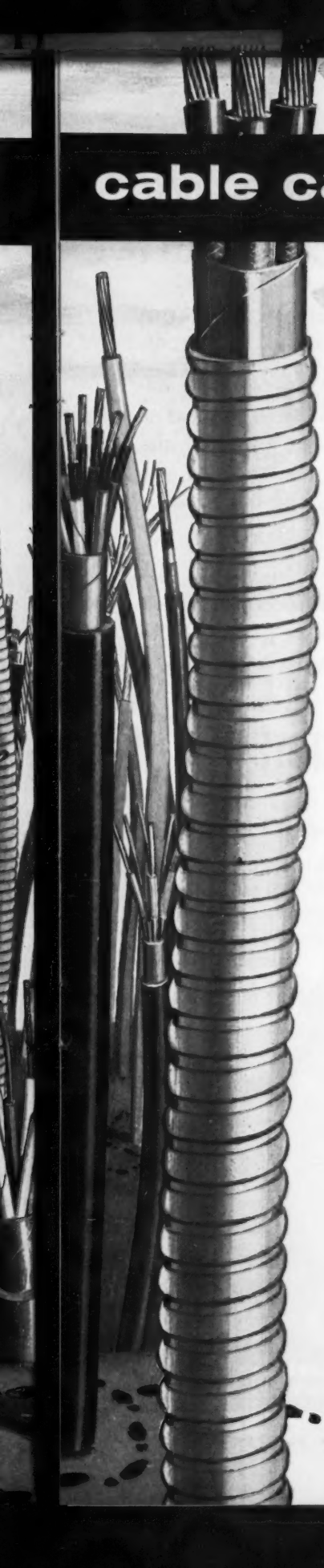
All Lapp Post insulators are built with hardware *externally* attached. Cracking is prevented because thermal movement or mechanical strains can load porcelain only in compression. This provides an extra margin of operating security, assures long insulator life and low line upkeep.

Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

Why selecting the right

cable can be a big problem



You have a plant to wire. You know all the wiring requirements that have to be met. You have catalogs showing an endless variety of power and control cables to choose from. Sure you can pick a *good* one. But how do you unerringly select the *best* for your job? Mostly, it's experience that turns up the *best* from a selection of *good* possibilities. Your own experience is important, of course. And . . . in making the best selection, it's important to remember . . .

How General Electric Can Help You

General Electric has helped many engineers in leading electric utilities and industrial plants solve their wire and cable problems. This experience is at your disposal.

What's more General Electric wire and cable engineers have solved innumerable problems of the same kind which have developed in General Electric's own facilities. And, of course, General Electric knows the requirements of the connected equipment—transformers, load centers, motors, controls, etc. That's experience, too.

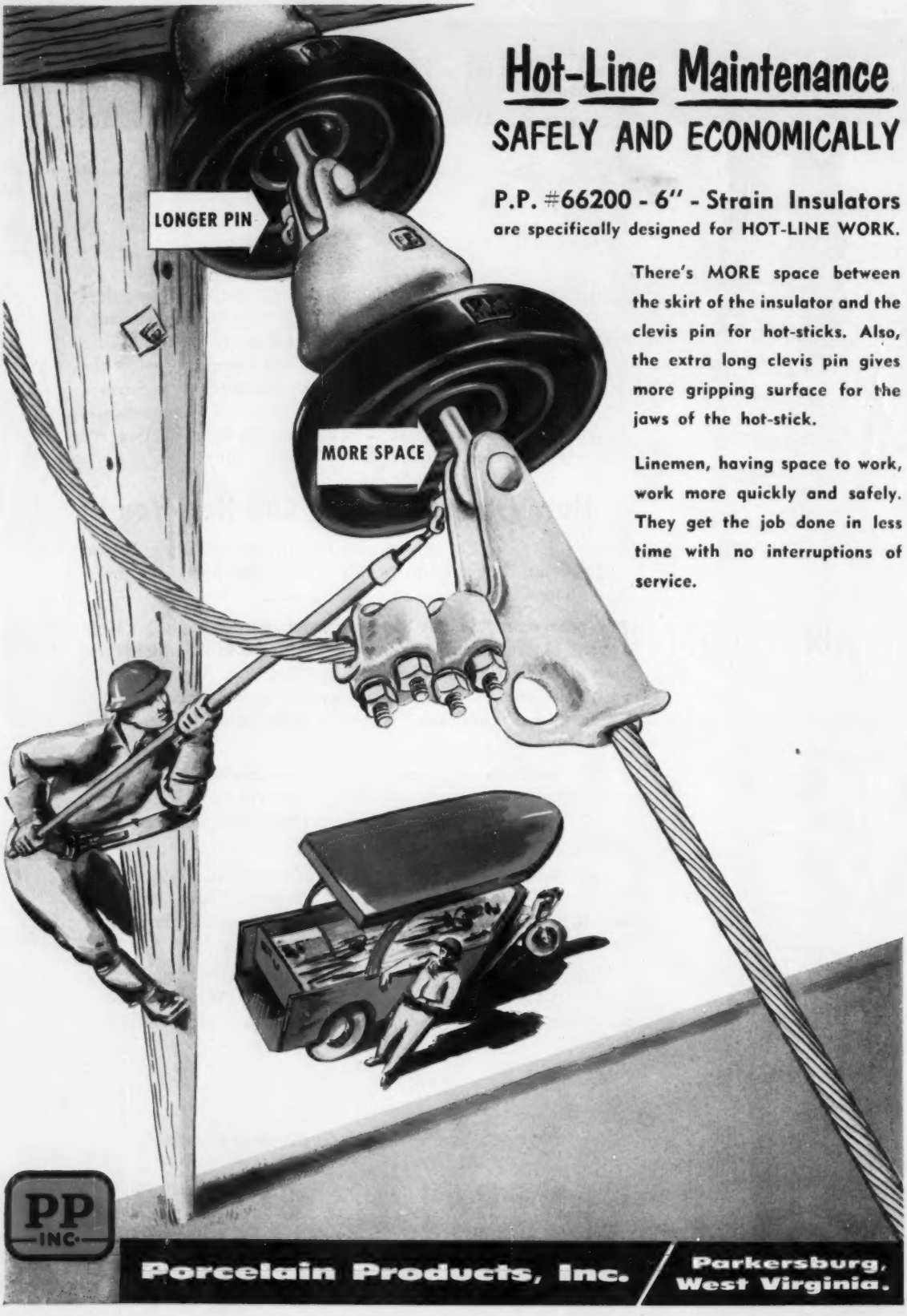
And, since the G-E line of cables covers almost every possible type and construction, these engineers can pick the one cable that will do a given job most efficiently, most economically.

Next time you have a wire and cable problem, why not call on General Electric engineers to help you? Their experience and the tested quality of G-E cables can become an important factor in the efficient operation of your plant.

Write for free information on the specific wire and cable problems that interest you. Address Section W179-427, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

Progress Is Our Most Important Product

GENERAL ELECTRIC



Hot-Line Maintenance
SAFELY AND ECONOMICALLY

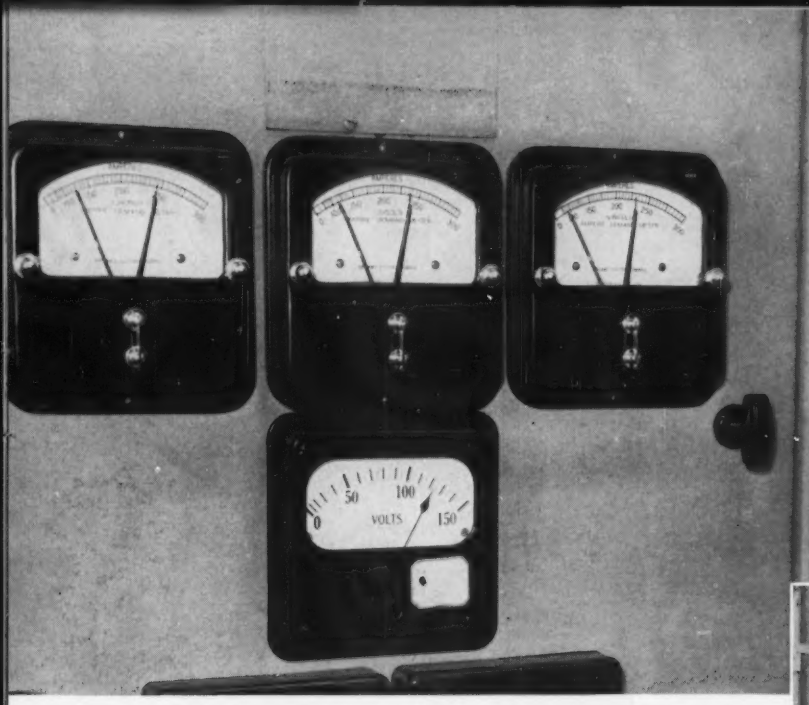
P.P. #66200 - 6" - Strain Insulators
are specifically designed for HOT-LINE WORK.

There's MORE space between the skirt of the insulator and the clevis pin for hot-sticks. Also, the extra long clevis pin gives more gripping surface for the jaws of the hot-stick.

Linemen, having space to work, work more quickly and safely. They get the job done in less time with no interruptions of service.

PP INC.

Porcelain Products, Inc. / **Parkersburg, West Virginia.**



THESE LINCOLN TYPE AD-2 Semi-Flush Switchboard Meters provide continuous information on feeder load and balance in an attended substation.

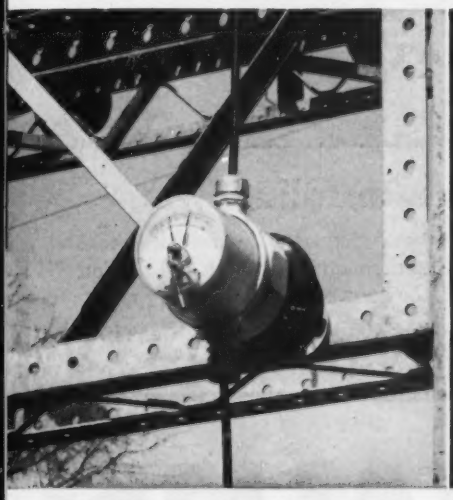
USE AD* MEASUREMENT FOR SYSTEM BETTERMENT

Helps you keep loads balanced to get the most out of system and distribution capacity

Lincoln Ampere Demand (AD*) Meters of the indicating type give you—at very low cost—the continuous information you need to load your distribution system to the ultimate safe limit. For the full story, just write Sangamo for information on "AD Measurement for System Betterment."

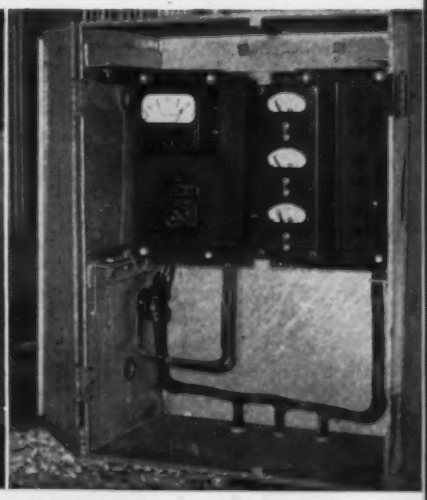
SANGAMO ELECTRIC COMPANY • Springfield, Illinois

LINCOLN ADS SOCKET TYPE Meters show loading and balance on phases in an outdoor substation.



THIS "HOT" TYPE AD-5 Lincoln Meter indicates amperes and balance on primary feeder circuits. Meter is insulated from ground with a post-type insulator and is arranged for hot stick reset.

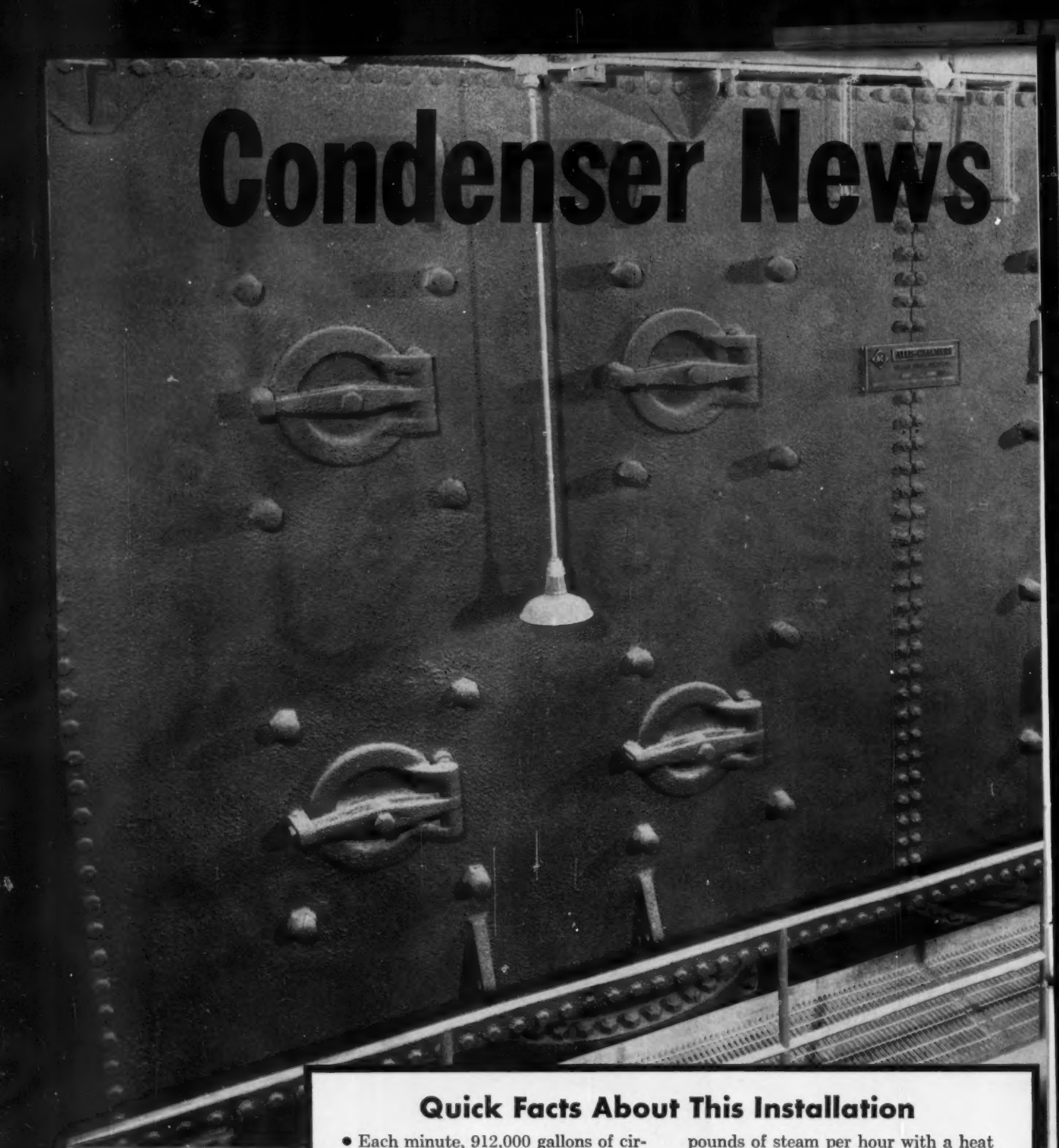
THIS LINCOLN ADN METER gives continuous facts on the load magnitude and load balance of "Y" connected transformers. No instrument transformers are necessary.



A TRIPLEX AD-2 INSTALLATION that shows load balance and current values on 4800 volt feeders in an outdoor substation.

SM56-1

Condenser News



Quick Facts About This Installation

- Each minute, 912,000 gallons of circulating water will be used in the condensers . . . enough for a city of approximately 8,750,000 people.
- Each condenser will handle 979,000 pounds of steam per hour with a heat rejection rate to water of 930 million Btu per hour.
- About 500 miles of tubing went into the six 100,000-sq-ft condensers.

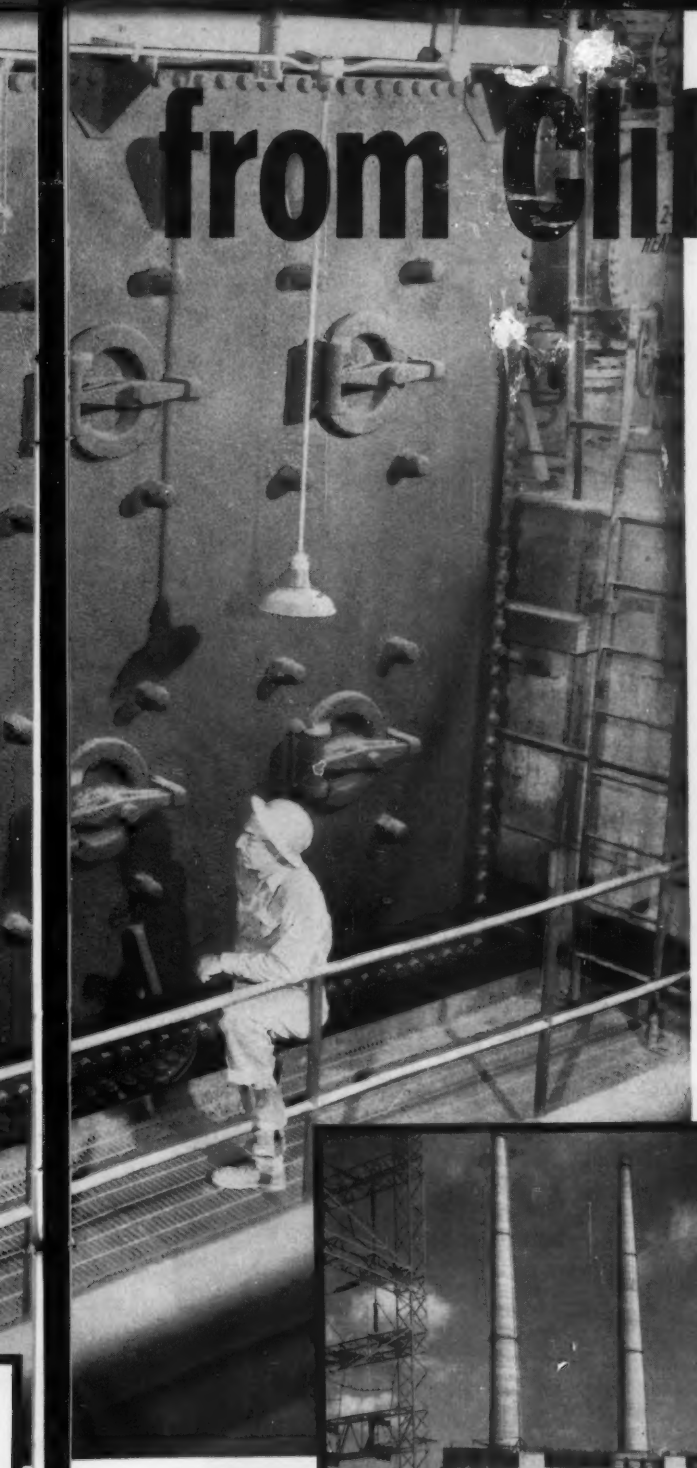
A Size and Type for Any Need

Round

Oval

Rectangular

ALLIS-



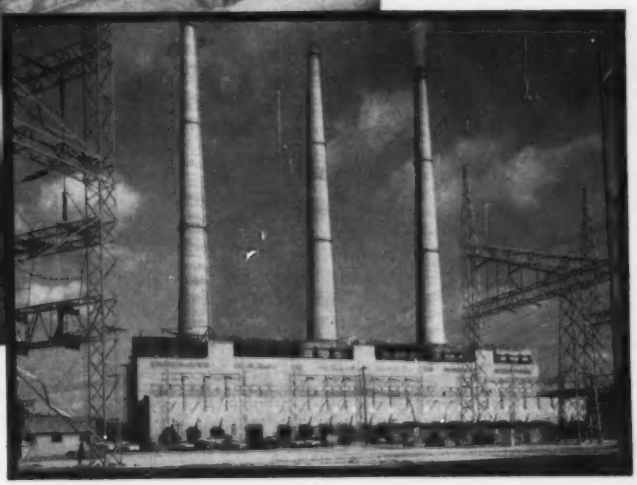
from Clifty Creek

World's Largest Investor Owned Generating Plant Completes Installation of Sixth Allis-Chalmers Condenser

More power for the Atomic Energy Commission! Giant Clifty Creek Plant, with a capacity of 1,290,000 kilowatts — more than that of Hoover Dam — is the largest power plant ever built by private enterprise.

Just completed, Clifty Creek is one of two major steam plants built by the Ohio Valley Electric Corporation to supply the electric power requirements of AEC's tremendous new Portsmouth (Ohio) atomic plant. Clifty is located on the Ohio River at Madison, Indiana. OVEC is sponsored by 15 private utility companies of the Ohio Valley region.

Six 100,000-sq-ft, single-pass Allis-Chalmers surface condensers serve the Clifty Creek Plant's six 215,000-kw steam turbine-generator units.



Condensers of Unusual Design

Multi-steam-path design is a feature of each condenser. This unique A-C design makes *all* tubes completely effective from one end to the other by directing steam to even the most remote sections of the condenser.

The result is high vacuum, high condensate temperature and good deaeration . . . in other words, high operating efficiency.

Get Information

For information about Allis-Chalmers multi-steam-path design, contact your nearest A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin. A-5038

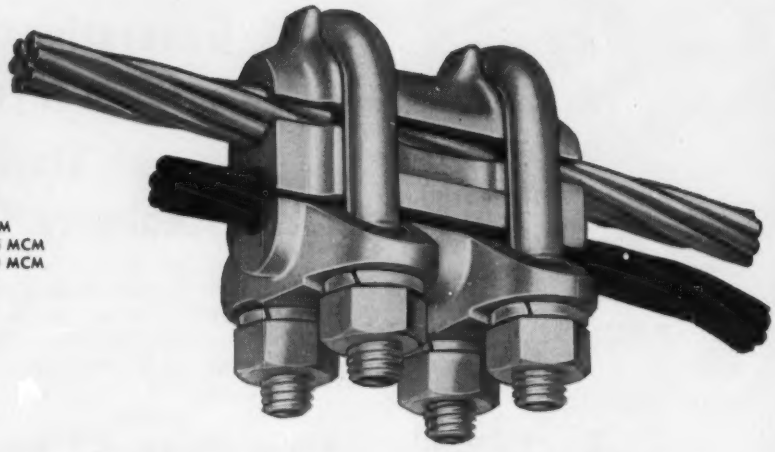
LIVE BETTER ELECTRICALLY

CHALMERS

A-C ALLIS-CHALMERS

CORROSIVE SOLDERING ELIMINATED!

in BLACKBURN'S Heavy Duty Bi-Metallic Connectors

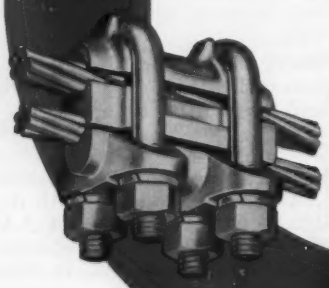


Sizes available to accommodate ACSR 2—[illegible].4 MCM Alum. 1 Str.—397.5 MCM Copper 4 Str.—250 MCM

PRESSURE SEALED, SHRINK-FIT COPPER LINER
SEALS OUT AIR AND MOISTURE—PERMANENTLY!

- Manufactured under controlled atmospheric conditions!
- Eliminating corrosive solders and fluxes between copper liner and aluminum casting insures permanent high conductivity.
- Factory applied protective coating prevents oxidation of contact spacer grooves during transit and storage.
- Castings are high-strength, heat-treated alloy with exceptionally heavy cross sections.
- Clamping forces are distributed over extra long surfaces—contour of grooves protects conductor.
- All Aluminum hardware is alumilited to prevent seizing—bolt features rolled threads of greater strength.

Sizes available to accommodate ACSR 2—[illegible]4 MCM Alum. 1 Str.—397.5 MCM



HEAVY DUTY ALL ALUMINUM CONNECTORS

Also available without copper liner for Aluminum to Aluminum. Coefficient of expansion same as conductor. Same high standard of material and construction as above connector.

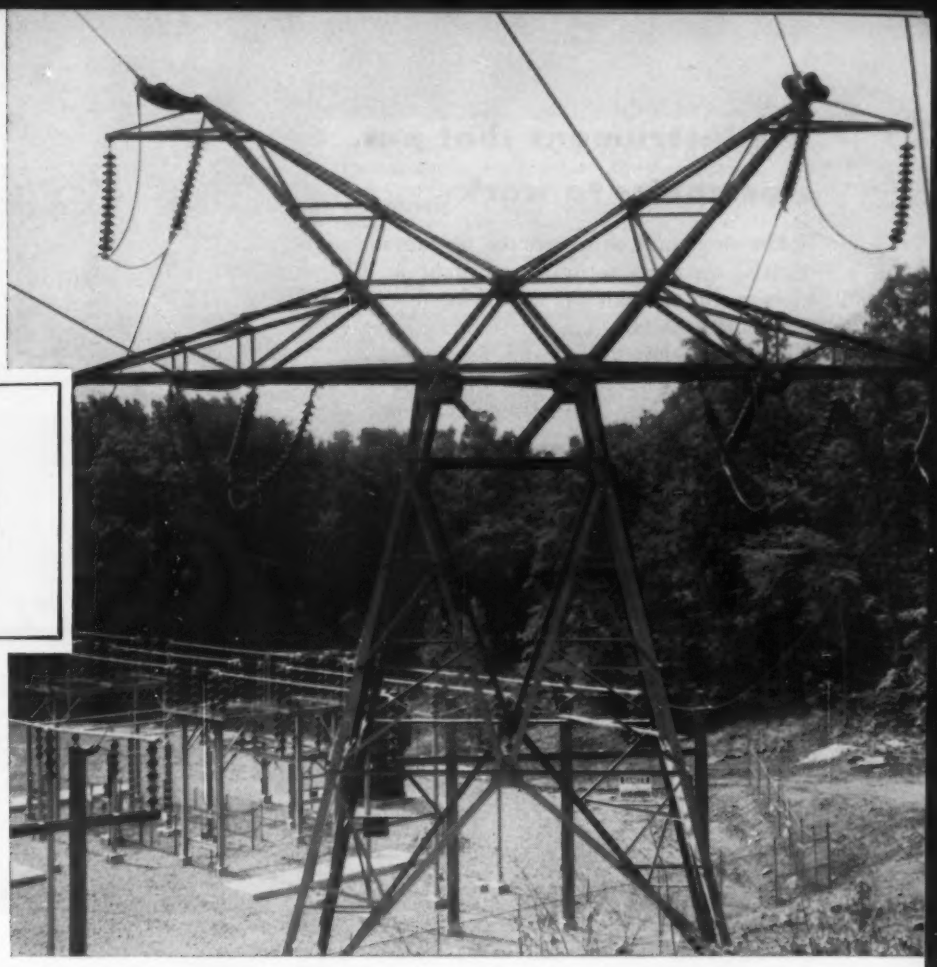
BLACKBURN Hi-Strength CONNECTORS

JASPER BLACKBURN CORPORATION — 55 MADISON ST. — ST. LOUIS 6, MO.
PHONE MAIN 1-2821

Especially Designed by

AMERICAN BRIDGE

for suburban communities



Transmission Towers *unobtrusive as trees!*

AMERICAN BRIDGE TOWERS

are made to order for every type of transmission line service.

Incorporating special design features such as steel grillage earth anchors and variable leg extensions, they make possible important savings in time, labor and material costs.

The rapid and continuing growth of suburban residential areas is creating a real problem for many power companies. For the extra load imposed on existing stations by the increased demand of power-hungry residential users can mean a drop in voltage, or more serious, too heavy a load on small pole-transformers.

The answer, of course, is to locate substations in strategic areas. But here, too, the utilities are often confronted with restrictive zoning ordinances or the objections of home owners.

Consolidated Edison was faced with such a situation in expanding its facilities in Westchester County, N. Y. It came up with a location shown in the above picture, for the Pleasantville substation. Working closely with American Bridge tower engineers, an attractive design was achieved. This is just one of five major substations and 19 small units which Consolidated Edison has planned for the improvement of its service in the immediate future in Westchester County.

American Bridge will fabricate the steel work for all of these modern, unobtrusively low and attractive substations and line towers. If you would like to know how we can help you solve your substation and tower problems, just contact the nearest office, or write direct to our Pittsburgh headquarters.

AMERICAN BRIDGE DIVISION, UNITED STATES STEEL CORPORATION • GENERAL OFFICES: 525 WILLIAM PENN PLACE, PITTSBURGH, PA.

Contracting Offices in: AMBRIDGE • ATLANTA • BALTIMORE • BIRMINGHAM • BOSTON • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT • ELMIRA • GARY HOUSTON • LOS ANGELES • MEMPHIS • MINNEAPOLIS • NEW YORK • ORANGE, TEXAS • PHILADELPHIA • PITTSBURGH • PORTLAND, ORE. • ROANOKE • ST. LOUIS • SAN FRANCISCO • TRENTON

UNITED STATES STEEL EXPORT COMPANY, NEW YORK

AMERICAN BRIDGE

USS

6-1018

UNITED STATES STEEL

The instrument that put electronics to work

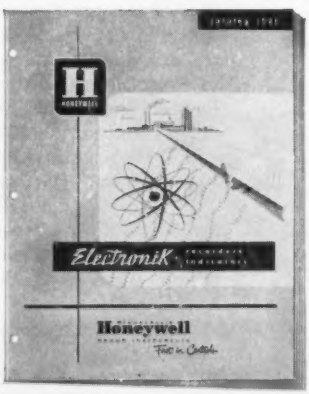
Before electronics came into the picture, industrial instrumentation was caught in a squeeze. On one hand, it was besieged with demands by production men and engineers for higher sensitivity, faster speeds, and greater reliability. And on the other hand, it was hampered by the limitations of mechanical devices. For the instruments of fourteen years ago were merely mechanical imitations of a man watching a galvanometer needle and twiddling dials. They were too delicate . . . too sensitive to vibration . . . too easily led astray by wear or maladjustment. They just couldn't deliver the performance that new production methods required.

In 1940, however, came a major milestone in the progress of instrumentation—development of the *ElectroniK* potentiometer. This was not only a new kind of instrument. It was a new concept of measurement. For the first time, it applied the science of electronics in a practical way to the design of a measuring device for industry. It replaced complicated, fragile mechanical gadgets with a simple but sensitive electronic circuit and servo system . . . the "Continuous Balance" principle of measurement.

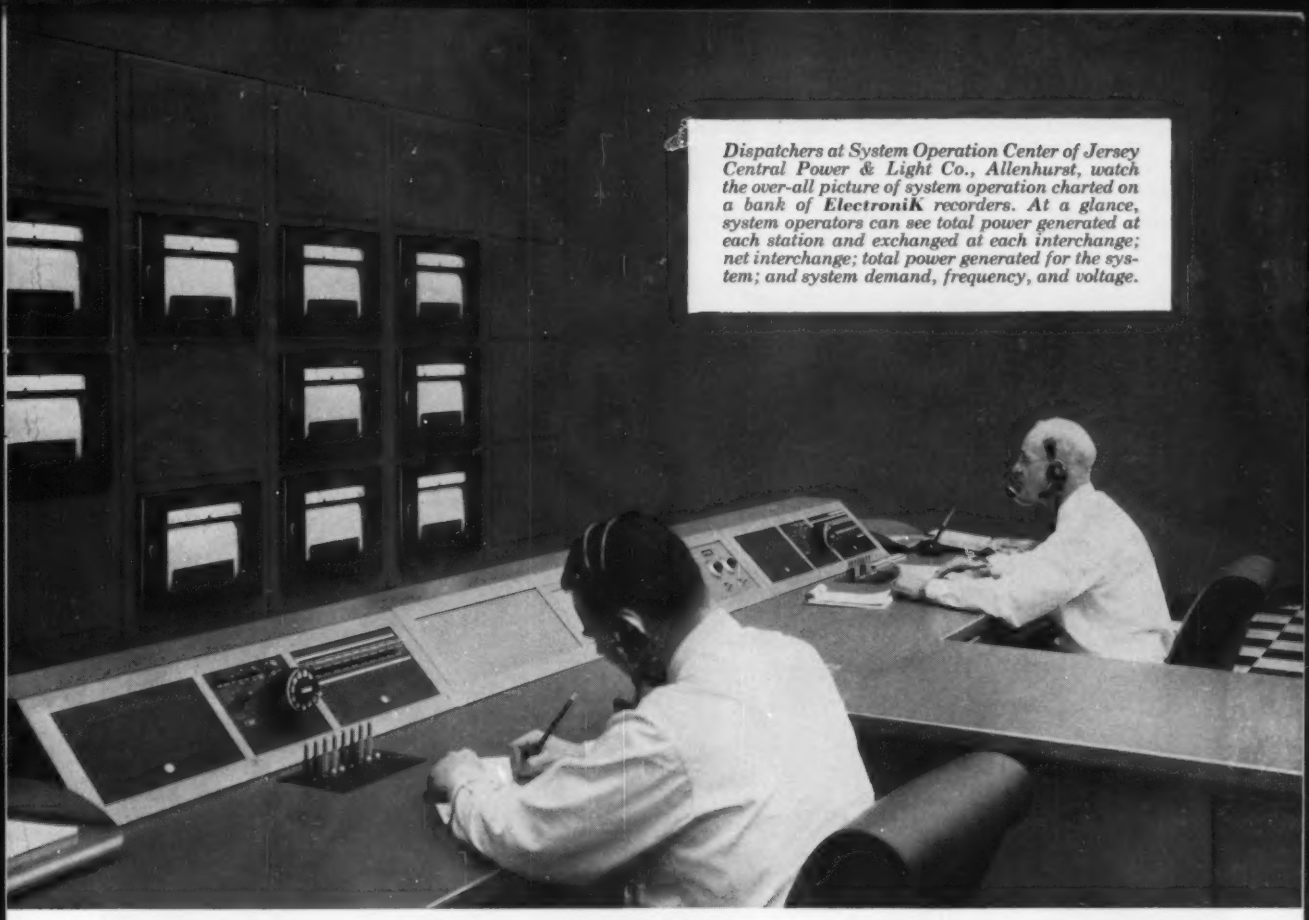
You could tell it was something new when you opened up the *ElectroniK* instrument's case. There was no sign of whirring gears, levers and cams. You could tell it was giving a new kind of performance in measurement, too, by the way the pointer would move swiftly and surely in one smooth sweep whenever the measured variable changed.

The *ElectroniK* instrument gained quick acceptance by production men, engineers, research technicians and maintenance men. They liked the way it provided laboratory accuracy and sensitivity, week after week, under the toughest industrial service conditions. They found that its speed and precision made possible improvements in product quality and process operation that had been unattainable before. And they have proved their confidence by ordering and reordering *ElectroniK* instruments by the thousands . . . not solely because it was *first* of its kind, but because it has continued to be the *best* in performance.

ElectroniK recorders present system data for



CATALOG 1521 *describes and illustrates the complete Honeywell line of* **ElectroniK** *recorders and indicators. Send for a copy for your file.*



Dispatchers at System Operation Center of Jersey Central Power & Light Co., Allenhurst, watch the over-all picture of system operation charted on a bank of ***ElectroniK*** *recorders. At a glance, system operators can see total power generated at each station and exchanged at each interchange; net interchange; total power generated for the system; and system demand, frequency, and voltage.*

Jersey Central Power & Light

HERE in this centralized control room, the System Operation Center for Jersey Central Power & Light Co., system operators must make minute-to-minute decisions that carefully balance power generation and interchange against changing demand. And their decisions have to be right to keep over-all operation at peak efficiency and economy.

Reliable, accurate data on load trends is instantly relayed from all points in the system to three banks of *ElectroniK* recorders. High-speed telemetering equipment transmits remote load facts to the recorders in split-second time.

By glancing at one group of *ElectroniK* recorders on the instrument panel, dispatchers quickly see total power generated at each of the system's major generating stations and exchanged at each interchange. These duplex 2-pen instruments simultaneously record both megawatts and megavars on the same chart. Other *ElectroniK* recorders show total system generation, net interchange, system load, system frequency, and voltage at the Raritan River generating station's 115-kv bus.

Versatile *ElectroniK* instruments handle a wide variety of indicating, recording, and control jobs throughout industry. In the power field, too—from generation through distribution—their speed, accuracy, and high dependability pay off in improved system operation. Your local Honeywell sales engineer will be glad to discuss flexible *ElectroniK* instrumentation to fit your specific system requirements. Give him a call . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

● **REFERENCE DATA:** Write for Data Sheets 9.1-3a, "Wide Chart Power Recorder"; 9.1-8a, "*ElectroniK* Frequency Recorder"; and 10.0-6a, "*ElectroniK* Duplex 2-Pen Recorder."

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

Alexander the Great, who, before he was 30 conquered almost all the known world, was history's hardiest character. Schooled by Aristotle, conditioned to endure unbelievable extremes of cold, heat, hunger and thirst, Alexander, though always outnumbered in battle, always triumphed.

GREAT... when it comes to endurance

Alexander the Great's physical endurance was legendary, well-nigh superhuman. Toughness and resistance were vital in Alexander's time . . . and they are today, too—in the cables that serve as the nerve system of transportation, power and industry.

Moisture, heat, cold, deteriorating elements, time itself—all combine to make inroads on cable installed underground, under water, or exposed to the air.

Kerite is designed to withstand these conditions—for years. Incredible as it may seem, Kerite Cable, in perfect operating condition after 30, 40, 50 and more years service in rugged applications throughout the world is the *rule* rather than the exception.

Nothing, of course, lasts forever . . . but Kerite lasts indefinitely. It represents one of the wisest investments in *service* that can be made.

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

Founded 1854

KERITE CABLE

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco;
3901 San Ferando Rd., Glendale 4, Calif.; 31 St. James Ave., Boston

EDITORIALS

Underground Heat Storms—the New Menace

Although not in the Weather Bureau's lexicon, heat storms are none-the-less real. They are as real, and perhaps more far-reaching, in their impact on utility systems as summer thunder storms, hurricanes, and similar weather phenomena.

Overhead systems in the Midwest plains states got a rude introduction to its effects during the summers of 1953 and 1954 (EW, Jan. 9, 1955).

For the underground systems, the first warning signs came last summer. During the hottest July on record, the simmering cities of the Northeast found their summer loads approaching winter peak levels, many for the first time. Air conditioning magnified and changed the shape of daily load curves. Load factors of underground circuits increased sharply, and diversity among cables in duct banks deteriorated.

But the very same heat storm that brought these changes in the character of underground system load also made vast inroads in the thermal capability of the cable systems that carried them. Sustained hot weather and lack of rainfall conspired to increase soil temperature and cut its ability to carry heat away from the duct banks. Duct temperatures rose without warning; and in situations where conditions were severe, runaway conditions developed, and epidemics of cable failures were the consequence.

In a special report in this issue, engineers of four major utilities that have come to grips with the problem paint a clear picture of the impact of heat storms on underground systems and what must be done to meet the situation.

In the words of authors H. L. Davis and C. R. North of Philadelphia Electric Co:

"The danger lies in maintaining present policies of duct loading through the next few years during which more nearly normal summer weather may prevail . . . and then having another heat storm."

It is to the recognition of such dangers that Electrical World has addressed its special report "The Heat Storm Goes Underground."

Watch This One Closely

One of the main principles involved in proposed revenue bond financing for the Tennessee Valley Authority is whether Congress will relinquish or lessen its fiscal control over the agency. Federal taxpayers have a $1.2-billion investment in TVA power facilities.

Congress authorized that investment and is responsible for safeguarding it.

Recent action by the House Appropriations Committee, if upheld by Congress, would ease the way for wide-open revenue bond legislation. The House Committee endorsed TVA's move to use power revenues to expand present TVA steam stations (EW, March 26, p 10). This is a first step toward giving the three-man TVA board the broad fiscal authority it is seeking in revenue bond legislation now pending before Congress. It is anticipated that the House will go along with committee action.

Thus, unless the Senate objects, the three-man TVA board this year will have authority to use its power revenues to expand further its electrical system. In the past a part of these revenues have been earmarked for payments on the $1.2-billion federal investment in TVA power plant. This raises the question as to whether future repayments on that investment will be jeopardized by the House Committee recommendation.

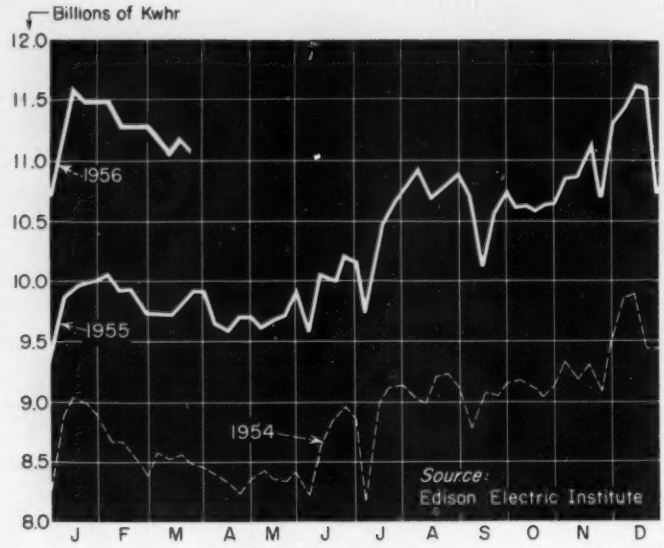
To us the action looks as though the committee majority is seeking a way to sidestep its responsibility for safeguarding the huge federal investment in the agency.

A five-man minority of the House Committee voiced strong objection to the committee action, contending that such use of TVA revenues is definitely prohibited in prior legislation.

While the amount of money immediately involved is relatively minor ($3.5 million), the language of the House report appears to open the way for considerable expansion of TVA without further Congressional authority.

Unless the principle of Congressional control of TVA fiscal policy is firmly upheld now, there is little chance that it will be revived under future TVA financing plans.

ELECTRICAL WEEK



OUTPUT

Week ended Mar. 24
11,134,000,000 Kwhr
Up 12.4%

Atomic Energy Commission requirements — 1,125,000,000 kwhr (Electrical World estimate). Excluding AEC output increases was 8.7%

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Mar. 24	+12.4	+7.6	+7.1	+18.8	+7.1	+15.2	+9.3	+6.4	+12.8	+7.5
Mar. 17	+14.1	+11.9	+10.8	+20.1	+11.5	+13.8	+10.0	+12.0	+16.4	+9.6
Mar. 10	+14.5	+11.9	+8.6	+23.1	+9.1	+11.9	+12.1	+10.8	+18.2	+14.2

Seasonally Adjusted Index 217.7 Week Ago 214.9 Year Ago 191.2

Issue's Highlights—Soviet Union's latest five-year plan calls for 83% hike in power output; 400-kv transmission link . . . Ohio Valley Electric puts 2,365,000-kw Clifty Creek plant into operation two months ahead of schedule . . . Elliott Co threatens to quit making generators because of foreign competition; urges government to change policy.

Reactor Chain Reaction Reported—What is said to be first accidental runaway chain reaction in a U. S. atomic reactor is believed to have taken place at AEC's Arco, Idaho, installation. AEC has made no announcement, and details are not known, of the accident, occurrence of which is dreaded by all engaged in reactor work. According to EW's information, someone "pushed the wrong button" at the experimental facility, and the reactor melted down quickly. AEC controlled experiments in past have shown that when reactor goes out of control the core becomes molten in minutes. Details of accident, when and if announced, may have important bearing on industry's current discussions about liability insurance.

Labor Settlement—Cleveland Electric Illuminating and UWUA have agreed tentatively on two-year contract providing package increase of 14.85¢ an hour for 2,500 employees.

Submetering Controversy—New York State legislature has passed bill removing freeze on submetering of electricity by commercial landlords. Consolidated Edison estimates it will lose $7.5 million a year revenues if measure is signed. PSC has opposed bill as "parasitic and undesirable."

Co-op to Vote on Sale—Sandy Electric Co-op, Sandy, Ore., will vote April 9 on whether to accept an offer of $1,007,300 by Portland GE for its 900-customer system. PGE has said it is a "willing but not an anxious buyer" of the co-op.

NEWS OF THE INDUSTRY BRIEFLY TOLD

Washington Wire—Bureau of Reclamation regional office report has reversed a previous finding and reported that Curecanti Dam would be feasible unit of Upper Colorado River Project . . . Reclamation also has awarded contracts for three generators to a foreign firm (see p 78) . . . Commerce Department will conduct atomic exhibition featuring reactors and assemblies in its Washington headquarters April 10-20.

EEI Sales Conference—EEI Pres Harllee Branch told last week's Chicago meeting: "Our opponents have been so much more enterprising than we in use of various channels of political communication and persuasion that we are far from winning the battle for preservation of the free enterprise system" . . . Harold Young, utility analyst, urged utilities to pay more attention to servicing appliances to avoid customer complaints . . . EEI Farm Section wiring report indicated that service entrance capacity is not uniformly sufficient to provide good farm electrification. Less than half of farms surveyed have more than 60-amp service.

EEI Sales Awards—Thomas W. Martin Award: Dayton P&L. **George A. Hughes Awards:** Texas P&L and Metropolitan Edison (electric range promotion), Georgia Power and Kentucky Utilities (commercial electric cooking). **Laura McCall Awards:** Cleveland Electric Illuminating, New Orleans PS, Cincinnati G&E, Atlantic City Electric, and Dayton P&L. **Lighting Promotion Awards:** Mississippi P&L (residential), Cleveland Electric Illuminating (commercial-industrial). **Better Light Better Sight Awards:** Cleveland Electric Illuminating, Dayton P&L. **Frank Watts Awards:** New York State E&G, Alabama Power, Wisconsin EP. **George Westinghouse Awards:** Kentucky Utilities, Metropolitan Edison. **More Power to America Awards:** Cleveland Electric Illuminating, Mississippi P&L.

Around the Circuit—Union Electric Co of Missouri is seeking SEC approval to divest itself of subsidiary Heavi-Duty Electric Co . . . Bonneville Power Administration is offering long-term contracts for 680,000 kw of interruptible power to electro-process industrial customers . . . Kansas G&E has elected Frederick M. Kimball, general sales manager, vice president.

ABOUT PEOPLE IN THE INDUSTRY

TVA Chairman Brig Gen H. D. Vogel cited to American Power Conference advantages enjoyed by TVA because it could operate for minimum earnings, paid no interest on obligations and no income taxes. These factors, he said, gave it consumer advantages not enjoyed by customers of private power companies. "Any talk about establishing a measure for the cost of power without reference to these factors is, of course, absurd."

Already "'Housepower' has sparked the imagination and gained support of many members of electrical industry," O. R. Doerr, chairman, EEI Commercial Division Executive Committee, told sales conference last week. "Housepower is spearheading a mass attack on residential inadequate wiring and is gaining strength as it steamrollers onward," This is "one of our industry's great promotional programs," he added.

More News About People page 154

Soviet Plans 83% Power Output Hike

- **Recent Communist Party Congress presents sixth and latest five-year plan**
- **Russian grid system in mill with 600 mi of 400-kv line linking north, south**
- **Completion of 13 hydro projects ordered; represents 16,250,000-kw capacity**

Spurred on by big talk from the big brass, Russian leaders attending the 20th Communist Party Congress in Moscow recently stretched their imaginations and visualized powerful strides in electric energy production and transmission over the next five years.

The Soviet Union's sixth and latest Five Year Plan, presented at the Congress and issued in the form of an order, calls for additional facilities to up electric power output to a whopping 83% in 1960 over last year's production and construction of a 400-kv line to link north and south power systems.

Hydro Completion Stipulated

The plan also calls specifically for completion of 13 projects totaling 16,250,000 kw by 1960 (see box). Generation target during that year has been set at 320-billion kwhr, an increase of 83% over 174.5-billion-kwhr output during 1955. Hydro generation, accordingly, has been ordered upped from last year's 38-billion kwhr total to 59-billion kwhr for 1960.

To achieve the desired generation the Congress ordered total turbo-electric capacity increased about 22 times and hydro capacity about 2.7 times.

Soviet Grid Planned

The Soviet grid, as visualized by the Congress for the European part of USSR, will connect Kuibyshev and Stalingrad hydro stations with the Central, South, and Ural Power Systems. For this a 400-kv transmission line will span the 600 miles from Kuibyshev to Moscow.

The line actually will consist of two wires, and the "southern" wire has been completed with 4,000 steel masts 72.6 ft high. Diameter of the cable used is 1.178 in. In order to decrease power loss during transmission, the three cables have been twisted into one strand.

A series of transformer plants have been erected along the power line to decrease voltage from 400 to 220 kv and from 220 to 110 kv, thus making the energy usable for local distribution nets.

In addition to the 400-kv line, the Congress ordered construction of a unified power system for central Siberia, from Novosibirsk to Irkutsk, and an interconnection for the Georgia, Azerbaidjan, and Armenian Power Systems. A blanket order also specified that all Soviet power lines between 35 and 220 kv be extended 2.2 times.

New 5-Year Plan Pushes These Hydro Completions

Plant	Capacity (thousands of kw)
Kuibyshev	2,100
Stalingrad	2,310
Saratov	1,000
Votkinsk	540
Lower Kama	900
Cheboksary	800
Kremenshug	450
Dnieprodzershinsk	250
Irkutsk	600
Bratsk	3,200
Novosibirsk	400
Krasnoyarsk	3,200
Kamensk	500
Total	16,250

Other Power Goals Set

Other orders contained in the Directives for the Development of the National Economy in 1956 to 1960, as presented by the Congress, pushed the following electrical power achievements:

- Further development of heating systems for industrial enterprises and large towns "to overcome the lag in the establishment of such system."
- Provision for power reserves of at least 10% in the unified European USSR system and other big systems.
- Extensive use at large thermo-electric plants of equipment capable of operating at a steam pressure of 130 atm and at temperatures up to 565C with intermediate steam heating, to achieve more economical operation.
- Installation of turbine blocks with a capacity of 200,000 kw capable of operating at a steam pressure of 220 atm and a temperature of 650C as well as a number of experimental and insurtial gas-turbine power plants.
- Technical re-equipment of electric power by high voltage direct current with operation of a d-c transmission line connecting Stalingrad hydro station with Donbas.

16 States Receive Hike Orders

In addition to the over-all directive, the Congress issued specific orders to 16 Soviet Socialist States. One state, the Tadjik Soviet Socialist Republic, was directed to increase its electric power output 4 times in the next five years and the Armenian Soviet Socialist Republic was ordered to effect an increase of 1.3 times. Other power-hike orders ranged from 1.4 to 2.1 times.

Westinghouse, UE Sign; Lester Plant Still Idle

The United Electrical Workers Union, Independent, with a membership employed at nine Westinghouse Electric Corp plants, reached agreement with the company early last week. The five-year pact, similar to the contract signed five days earlier with AFL-CIO's International Union of Electrical Workers (EW, March 26, p 8), returned one-third of UE's 9,200 members to work at eight plants.

At mid-week, settlement had still not been reached at the Lester, Pa., plant where 6,000 members are out in dispute over local issues, including incentive pay rates. Westinghouse has proposed substitution of a day-rate basis instead of the incentive plan. This has been rejected by James J. Matles, UE director of organization, who declared "settlement will be hard to come by" as long as the company maintains its present proposal.

CEA's LORD CITRINE AND MALENKOV HOIST CLARET TOASTS

SIR COCKROFT, MALENKOV PREPARE FOR A-PLANT TOUR

Malenkov Tours Harwell and Other British Power Stations

Former Soviet Minister Georgi Malenkov, now Minister of Power Stations, recently visited Britain's atomic energy research stations at Harwell as part of a three-week study tour of the United Kingdom's power stations and installations.

Wearing protective white coat and overshoes (right photo), Malenkov and Sir John Cockroft, director of Atomic Energy Research Establishment, prepare to enter Harwell's Chemical Laboratory. Left photo shows Malenkov with Lord Citrine, Central Electricity Authority chairman, toasting each other at the Russian embassy.

Malenkov, along with 12 Soviet electrical engineers, technicians, and advisors, are also touring the nuclear power stations at Calder Hall and British electrical manufacturing plants including General Electric Co and Babcock & Wilcox, Ltd, at the invitation of the Central Electricity Authority. A similar British group is due to visit Russia next month on a reciprocal tour.

OVEC Spins Clifty Creek Ahead of Schedule

Completion of the 1,290,000-kw Clifty Creek Plant, second and final step of a $385-million construction program, has been announced by Ohio Valley Electric Corp.

Clifty Creek, hailed as the world's largest privately-owned power plant, is located at Madison, Ind., on the Ohio River, 50 miles downstream from Cincinnati. Its sixth 250,000-kw unit went on the line last week, two months ahead of schedule.

A joint venture of 15 private electric utility companies, the corporation's new plant and its five-unit sister station at Cheshire, Ohio, Kyger Creek, (EW, Jan. 2, p 8), will supply the Atomic Energy Commission's Portsmouth (Ohio) Project. The facilities, with combined generating capacity of 2,365,000 kw, were completed in 39 months.

"For size, scope, and speed, the OVEC accomplishment is unparalleled," said Philip Sporn, OVEC president and head of American Gas & Electric Co, parent firm of three of the project's participating utilities.

"All of us who have taken part . . . ," he said, "are very proud that it has been brought about ahead of schedule and with maximum economy and efficiency by the 15 companies, working together."

The contract with AEC was signed in October 1952 and ground was broken for both plants in December of that year. According to its latest estimates, OVEC will sell up to 17-billion kwhr a year at rates slightly less than it predicted four years ago. This despite escalation totaling millions of dollars in material and equipment costs and increased labor and coal costs. The early completion date will save AEC several million dollars and accelerate its construction schedule, according to OVEC.

Power from Clifty and Kyger Creek Plants will be delivered via 380 miles of double-circuit, 330,000-v transmission lines. The sponsoring companies are inter-connected with the plants. The gigantic Portsmouth Project utilizes the energy in large-scale separation of the isotope U-235 from natural uranium.

Plan New Construction

Mississippi Power Co will spend $12 million this year for new facilities. More than half the budget goes to initial 75,000-kw unit of new plant between Gulfport and Biloxi.

Main item on Northern Indiana Public Service Co's 1956-57 construction budget of $52-million is first 130,000-kw unit at Dean H. Mitchell Station, Gary, Ind.

Equipment Maker Protests

Elliott Co seeks return to 25% differential on foreign bids for electrical equipment; threatens to quit making generators

A small Pennsylvania electrical equipment manufacturer, fed up with submitting fruitless bids on government contracts invariably awarded to foreign firms, has taken the Administration's Buy-American policy to task.

The firm is the Elliott Co, which has generator manufacturing plants in Jeannette and Ridgway, Pa., and Springfield, Ohio, and Newark, N. J.

Elliott's chief spokesman on Buy American, Ridgway Division Sales Manager F. E. Millan, is carrying on a one-company campaign to rally American equipment makers for an all-out assault on the Administration's liberal policy toward foreign bidders on electrical equipment. Millan has sent out letters to most of his domestic competitors urging a common effort to push the Administration back toward the previous 25% Buy-American differential. Foreign bids are now considered acceptable on federal projects if they are no more than 6% higher than their American counterparts.

Elliott's is a last-ditch effort, for Millan says if there is no change in the current policy, the company will be forced to convert its generator-making facilities to other uses, probably manufacture of mechanical equipment. This, he warns, would weaken the United States' ability to fight a war, as other companies may be compelled to do the same thing.

In recent months, Millan has sent out three letters to government officials on the matter.

• One, dated Jan. 25, was sent to Rep Leon H. Gavin (R-Pa.). In that, Millan pointed out that Elliott was apparent low domestic bidder at $614,500 on two 13,333-kva, 180-rpm alternating current generators for hydraulic drive for Bureau of Reclamation's Glendo (Wyo.) plant. Two foreign bids were considerably lower: Stab. Elettromeccanici Riuniti Ansaldo —San-Giorgio of Genoa, Italy, at $478,000; American Elin Corp of New York, to be made in Weiz, Austria, at $523,805. These bids include the cost of transport to dam site, plus 15% import tax. Elliott's did not include the approximately $13,000 in freight costs for delivery to the dam site.

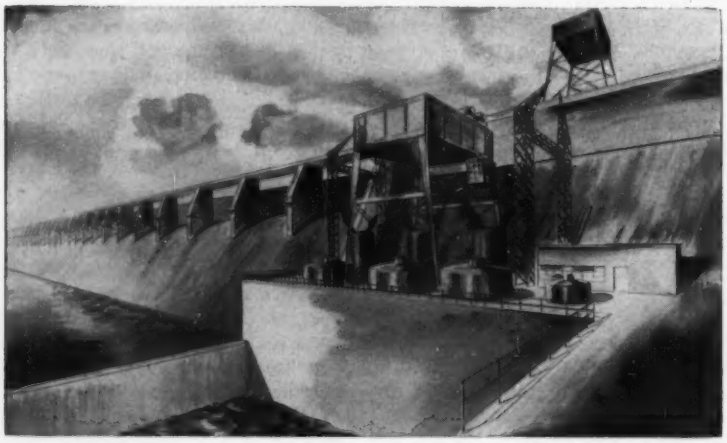
Bid Submission Called Fruitless

• A second letter, dated Feb. 10, to L. N. McClellan, assistant Bureau of Reclamation commissioner and chief engineer, Denver, returned specifications on a generator for the Roza Plant (Yakima Project, Wash.) without a bid. Millan said results of the Glendo bidding indicated to Elliott officials that "we cannot possibly reduce our bid price sufficiently to be competitive with foreign bidders." He also said: "As long as foreign bidders are acceptable, we do not feel the Elliott Co should spend money for preparing preliminary information on such projects, nor for submitting bids."

• A third letter, dated March 2, to Gavin, said, in effect, "we were right" on the Roza results. Bids on the 11,250-kw, 225-rpm hydraulic turbine driven generator were as follows:

Ansaldo of Genoa, Italy	$205,583
Ernesto Breda de Milano	221,633
American Elin of Austria	223,260
General Electric Co	257,723
Westinghouse Electric Corp.	270,676
Electric Machinery & Manufacturing Co	301,801
Allis-Chalmers Manufacturing Co	302,355

The letter said: "You can see from the results of the bids which are similar to those on Glendo that I saved the Elliott Co the cost of preparing a fruitless bid. Unfortunately, however, if something is not done we will have to divert our facilities used for manufacturing hydraulic turbine-driven generators to other uses. Such diversion, of course, will mean that these facilities are no longer available for manufacture of this class of equipment and we will not be bidding on such government projects even in the time of emergency."



Georgia Power Seeks FPC Go-Ahead

Application for a license to build a 60,000-kw hydro plant and dam (sketch shown above) on the Chattahoochee River has been filed by Georgia Power Co with the Federal Power Commission.

The James M. Oliver Project, named for the utility's vice president and general manager, will cost an estimated $13 million and is proposed as the third link in Middle Chattahoochee development. Combined capacity of the three dams will be 92,900 kw. The federal government will have an option to build navigation locks in the projects.

Preliminary construction work has been carried on under a temporary FPC permit for the past year.

The Pennsylvania delegation in Congress, spurred on by the Elliott Co's complaints and those of other Pennsylvania firms unsuccessful in bidding on government business, plans to question Arthur Flemming, Director of the Office of Defense Mobilization, to pin down responsibility for the decision to cut the Buy-American differential from its previous 25% to about 6-10%. The White House established its policy officially in December 1954.

While Elliott Co carries on its fight to mobilize the industry, Congress is showing an inclination to support President Eisenhower's liberalized foreign trade policy.

House Unit Endorses OTC

The House Ways and Means Committee voted last week to endorse the President's suggestion for establishment of an Organization for Trade Cooperation, to be the administrative arm of the trade and tariff negotiating agency known as the General Agreement on Tariffs and Trade (GATT).

At hearings on this legislation, A. F. Metz, chairman of the board of Okonite Co, representing the National Electrical Manufacturers Association, said:

"It seems hardly believable that the administrative agencies of this great government unanimously would place responsibility for its foreign trade in the hands of an international agency in which it has less than a 3% voting interest."

Metz also said the bill to set up OTC "is a device to remove tariff protection by fiat even for those industries whose products are the base of our defense manufacture." He said removal of this tariff protection will ultimately result in "the wasting away" of productive enterprises, with an accompanying weakening of our national defense.

Plan France-England Link

Four submarine cables may interconnect France and England's electric systems if both governments approve a proposal based on nearly completed experiments conducted across the English Channel. Subject to the sanction of Electricite de France and England's Central Electricity Authority, the plan would take two to three years to complete.

Priest Rapids Talks to Reopen

Grant County PUD receives low bid for 684,000 kw project, to confer with prospective customers over controversial terms

Officials of Grant County Public Utility District, Ephrata, Wash., have received an attractive bid for construction of 684,000-kw Priest Rapids Power Project on the Columbia River and plan to meet soon with prospective purchasers to negotiate terms of the power purchase contract.

The project was recently proved feasible from a construction point of view when PUD received a low bid of $91,878,625 from Merritt, Chapman & Scott of New York to construct the dam and powerhouse and to furnish all necessary powerhouse equipment. This bid, lowest of five, is believed to be well below estimates compiled by engineers.

The PUD has been negotiating terms of the contract with prospective customers, including a number of municipal utilities, for several months. Aluminum Company of America, a new prospect, recently indicated interest in buying half of the dam's 684,000-kw output for use at a new reduction plant it would build near Priest Rapids, and has also requested an option on power from Wanapum Dam, to be constructed later.

Contract Terms Cause Conflict

Several controversial provisions in the proposed contract, however, have slowed down proceedings between the PUD and prospective customers. Among them are:

- PUD's plans to negotiate sale of revenue bonds to a syndicate headed by Halsey Stuart & Co. Representatives of the municipal utilities pointed out, however, that their charters banned participation in a contract unless competitive bidding were specified.
- PUD's plans to sell the entire output of 684,000 kw to be produced at Priest Rapids, reserving the right to withdraw power from its customers at a later date. Customers protested against these terms, and the PUD now proposes to reserve for itself one-third of the output.
- PUD's proposal that one of its representatives serve as chairman of a board of arbitrators to be established in the event a dispute arose between PUD and an advisory committee representing the purchasers. This provision is expected to be deleted from the new contract.
- Provision as to the recipients of the power after the expiration of the 50-year contract. PUD has indicated it would like to reserve this power for itself but prospective purchasers balk at this provision.
- Seattle City Council's objections to a provision in the power purchase contract which requires that purchasers must continue to pay for electric energy "regardless of interruption or cessation of delivery for any cause whatsoever." The Seattle corporation counsel has ruled the city cannot legally enter into a contract with such a provision. But backers advising the PUD declare this provision is necessary to assure sale of the revenue bonds needed to finance the project.

Contractor Withdraws Suit

Meanwhile, withdrawal of a suit against the PUD filed by Paul G. Ellis, an Ephrata contractor, has brought construction of the project nearer.

Ellis's suit, which proposed to clarify PUD's authority to lawfully contract to build the dam, had been contested by PUD officials. The suit asked for a permanent decree preventing further work on the project by the PUD until Ellis's questions about its legality were answered.

Debt Incurrence Called Illegal

The suit alleged that, in contracting to sell 70% of Priest Rapids power outside the county, the PUD was acting primarily in the interest of customers outside its service area. Through the project, the suit said, PUD would acquire higher debts than the law allows.

Priest Rapids Dam is planned as the first unit in a two-dam project to cost about $360 million. The smaller 570,000-kw Wanapum Dam, 18 mi upstream from Priest Rapids, will be handled as a separate unit. Construction on Priest Rapids is scheduled to begin by July 1 in accordance with terms of a license from the Federal Power Commission.

Government Pushes Standards

Defense, General Services spokesmen urge NEMA to prepare standards more suitable for government, praises work done

Spokesmen for the Department of Defense and the General Services recently urged the National Electrical Manufacturers Association to emphasize development of electrical equipment standards more suitable for government use. At the same time NEMA was praised for furthering industry-government cooperation by helping prepare federal and military standards and specifications.

This prod and praise for NEMA came during the first of two symposia at the organization's winter meeting in Chicago. The government speakers were Roger E. Gay, director of cataloging, standardization, and inspection, Office of the Assistant Secretary of Defense (supply and logistics), and Willis B. MacLeod, director of Standardization Division, Federal Supply Service, General Services Administration.

Gay, in discussing the Federal cataloging program in the Department of Defense, said that it is endeavoring to establish "a single uniform identification language for items of supply."

Approximately 20% of the DOD items have been converted to the new language, Gay said. He remarked that the schedules call for the Army to complete conversion by October 1957, and the Navy, Air Force, and Marine Corps by the end of 1958.

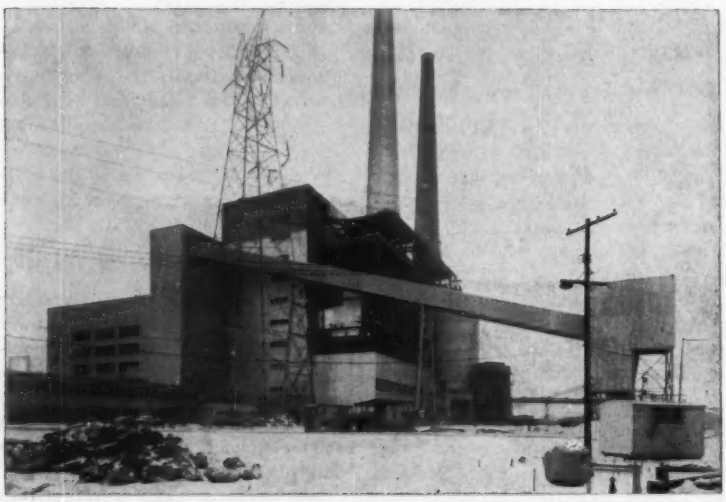
In the standardization program, one part is the development of purchase specifications to assure an equitable basis for making an award and to call for an item of standard production. Second part is the development of standards. The aim of the program is to reduce costs and the varieties of items that must be handled.

MacLeod informed the NEMA members that the joint DOD-GSA standardization team is designed to bring about uniform and non-duplicative purchase specifications and standards for government military and civil agencies. MacLeod pointed out that more than 1,200 industry standards already have been adopted.

Marking advance of the Federal Catalog Program in civil agencies, MacLeod stated that about 28,000 GSA Stores Stock and Federal Supply Schedule items will be cataloged in 1956. By the end of 1957, he added, the job will be over if Congress appropriates funds for cataloging 120,000 additional items that year.

The second symposium was concerned with the problem of providing electrical inspectors with the necessary assurance of the safety of equipment which presently carries no indication of conformity to nationally recognized safety standards.

Participants in the panel were representatives of the NEMA Safety Regulations and Codes and Standards Committee, together with key members of several NEMA apparatus sections. NEMA's Joint Sections Committee will prepare a plan of action.



Detroit Ed Spins River Rouge Unit

First unit at Detroit Edison Co's River Rouge Plant has begun feeding 260,000 kw into the company's southeastern Michigan power pool.

The addition raises Detroit Edison's total capacity to 2,795,000 kw, and is first of three units. The second and third units will be completed next year. Charles T. Fisher, Jr, a member of the company's board of directors, performed the first unit's turn-over in a brief ceremony.

Producers Up Prices on Aluminum, Copper

Both aluminum and copper producers have kicked up their prices recently.

Aluminum—Kaiser Aluminum & Chemical Co and Reynolds Metals Co upped aluminum prices by 1½¢ a pound bringing primary pig to 24¢ and ingot to 25.9¢. The increases are attributed to rising costs of building new production plants, freight rate hikes, and higher labor costs. Aluminum Co of America later hiked per-pound prices 1.5¢ across the board on all types and grades.

Copper—Anaconda Co has changed pricing policy on copper mined in Chile. U. S. customers are paying world market prices which last week ranged between 51-52¢ a pound for the metal. The change was described as one which reconciles efforts of the Chilean Government to establish a uniform world-market price base.

Copper industry spokesmen felt the metal was pricing itself out of the market and pointed to warning signs. Domestic custom smelter per pound prices dropped last week to 51¢—4¢ below high of two weeks ago. A comparable dip of about 5¢ was felt on the London Metal Exchange, where copper prices were at 49¼¢ bid.

Congressional Scoreboard for Utilities

(Reporting Changes in Status of Legislation Since Charted by EW, Feb. 27)

Identification	Explanation	Status
GOVERNMENT POWER AGENCIES:		
TVA Financing		
HR-10004	TVA request for $3.5-million appropriation to order equipment for 180,000-kw unit at John Sevier Steam Plant, contained in second supplemental appropriations request for fiscal 1956.	Bill approved by House Appropriations Committee, except for TVA appropriation request. Agency directed, instead, to apply power revenues to finance new equipment.
HYDRO ELECTRIC PROJECTS:		
Niagara Development		
S-1823 (Lehman: D-N.Y.)	Directs FPC to license N.Y. State Power Authority to develop hydro power, with federal preference provisions.	Reported by Senate Public Works Committee. Early Senate consideration of bill promised.
Upper Colorado		
HR-3383 (Aspinall: R-Colo.) S-500 (Anderson: D-N.M. and nine others)	Bills differ. HR-3383 authorizes four large storage units in upper basin. S-500 authorizes those included in House bill plus Echo Park.	House-Senate conference has agreed to adopt House-passed bill, limiting authorization to $760 million for Glen Canyon, Flaming Gorge, and Navajo projects, the three initial reservoirs (EW, March 12, p 8). Power output would be about 900,000 kw.
OTHER LEGISLATION:		
Highway Relocation		
HR-8836 (Fallon: D-Md.)	Provision in federal highway bill for reimbursing utilities for relocation costs necessitated by highway construction.	House subcommittee approved provision permitting federal payment up to 50% of such relocation costs so long as they do not exceed 2% of the cost of each road-building project. This replaces previous language providing federal reimbursement of state payments to utilities for this purpose.
Atomic Insurance		
HR-9710 (Price: D-Ill.)	Authorizes federal indemnity of liability at private nuclear power plants for amounts exceeding insurance coverage available from private carriers at reasonable rates. A 10-year limitation is included. Private carriers have indicated they will underwrite up to $60 million in liability risks at each facility.	Introduced. Joint Congressional Atomic Energy Committee held two-day seminar with private individuals to discuss the insurance problem. Action is promised soon.
HR-9802 (Cole: R-N.Y.)	Limits nuclear reactor owners' and manufacturers' liability to twice the capital investment in a plant.	Introduced.
Holding Company Act		
HR-9743 (Cole: R-N.Y.)	Amend act of 1935 permitting joint sponsorship of atomic power ventures without necessity of registration as holding companies unless already subject to the act.	Introduced.
SPA Rate Hike		
S-3338 (Kerr: D-Okla. and 15 others) HR-9664 (Trimble: D-Ark.) HR-9721 (Albert: D-Okla.)	All three bills prevent rise in Southwestern Power Administration rates for 18 months. Interior Department withheld application to Federal Power Commission for 40% increase at Senate committee's request. Sponsors want time to consider it.	Introduced. Senator Kerr attempted to tack his bill on farm bill but was overruled. House sponsors are expected to try to pin the prohibition on public works money bill.
REA:		
S-3327 (Smith: R-Me.)	Provides that Hoover Commission recommendations be carried out to put Rural Electrification Administration on a pay-as-you-go basis.	Introduced.

480/277-V Distribution Saves Over

DISTRIBUTION
Design

Supplied from six 2,000-kva transformers in spot network with high-reactance, current-limiting busway to main switchboard

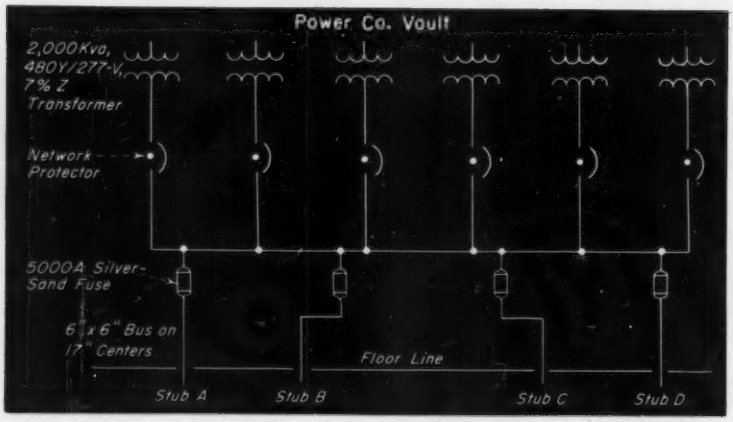


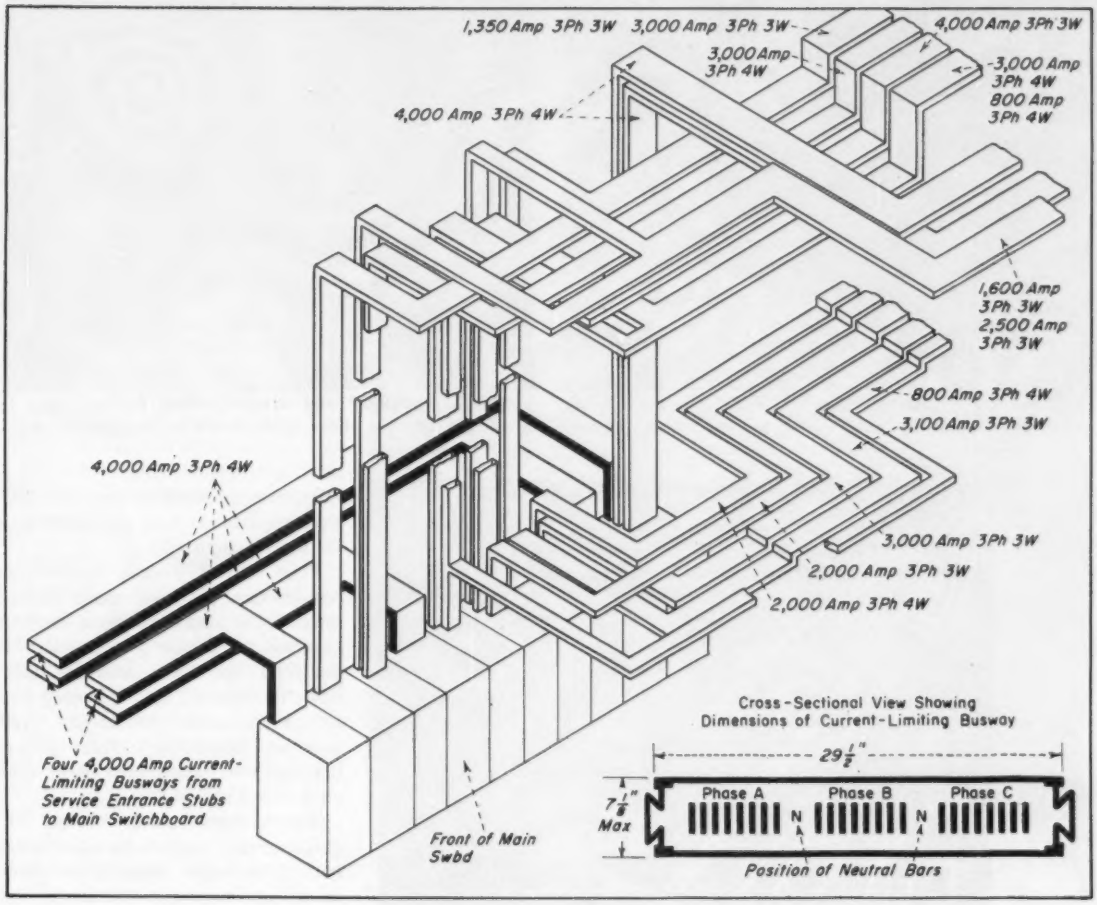
FIG 1—THE 480Y/277 (265/460)-V SPOT NETWORK, consisting of six 2,000-kva transformers, is one of largest at that voltage set up in commercial building

LAWRENCE E. FISHER, and HOWARD D. KURT,
General Electric Co, Plainville, Conn.

More than $1,500,000 was saved in electrical equipment by installing a 480Y/277-v distribution system in New York City's 20-story Coliseum building. This saving was in first cost, but future additions to the distribution system will have commeasurable economies.

This office building, with 365,000 sq ft of display space, thus has one of the largest 480/277-v systems in a commercial structure.

The Coliseum is in a secondary network area, but it was apparent early in the design stage that 120/208-v service would require feeder runs



$1.5-Million on Coliseum Building

larger than were practical. On the other hand, doubling the voltage would permit use of a feeder of any given ampere rating for transmitting twice the usual power for twice the distance at the same percentage voltage drop. Accordingly Consolidated Edison Co made available a 480/277 (265/460)-v spot network.

Service to the Coliseum (Fig 1) consists of four 3,500-amp stubs supplied by a 480/277-v spot network comprising six 2,000-kva transformers. This large concentration of capacity and the reduced effect of circuit impedance at 480 v make for extremely high levels of short-circuit duty at the entrance stubs. The short-circuit duty at the stubs, including the motor contribution, is approximately 186,000 amp rms asymmetrical. To reduce this level to 100,000 amps at the main

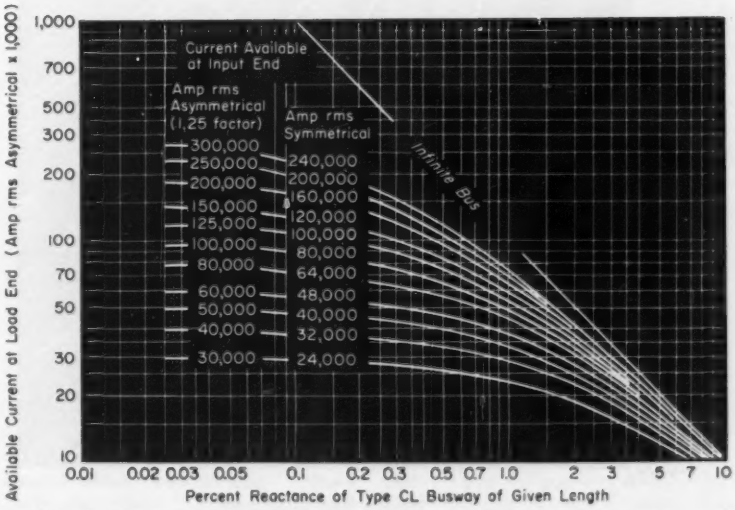
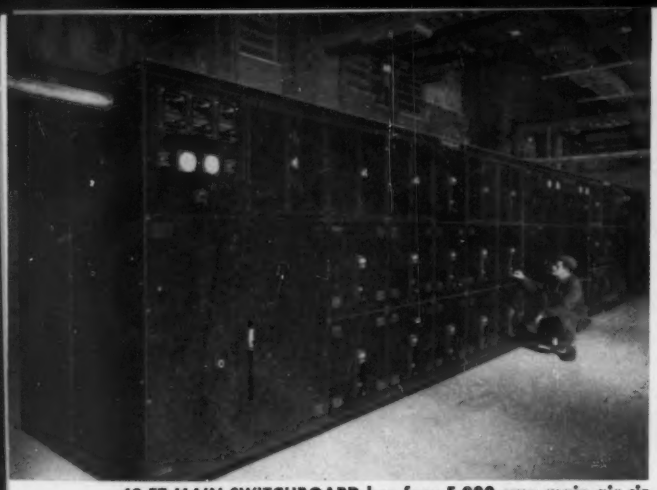


FIG 3—CURVES determine the short-circuit current available at load end of busway or length of busway needed for a given reduction in short-circuit level



40-FT MAIN SWITCHBOARD has four 5,000-amp main air circuit breakers, one for each run of current-limiting busway

LOW-VOLTAGE-DROP and current-limiting busway used in the Coliseum were of the types shown in photograph above

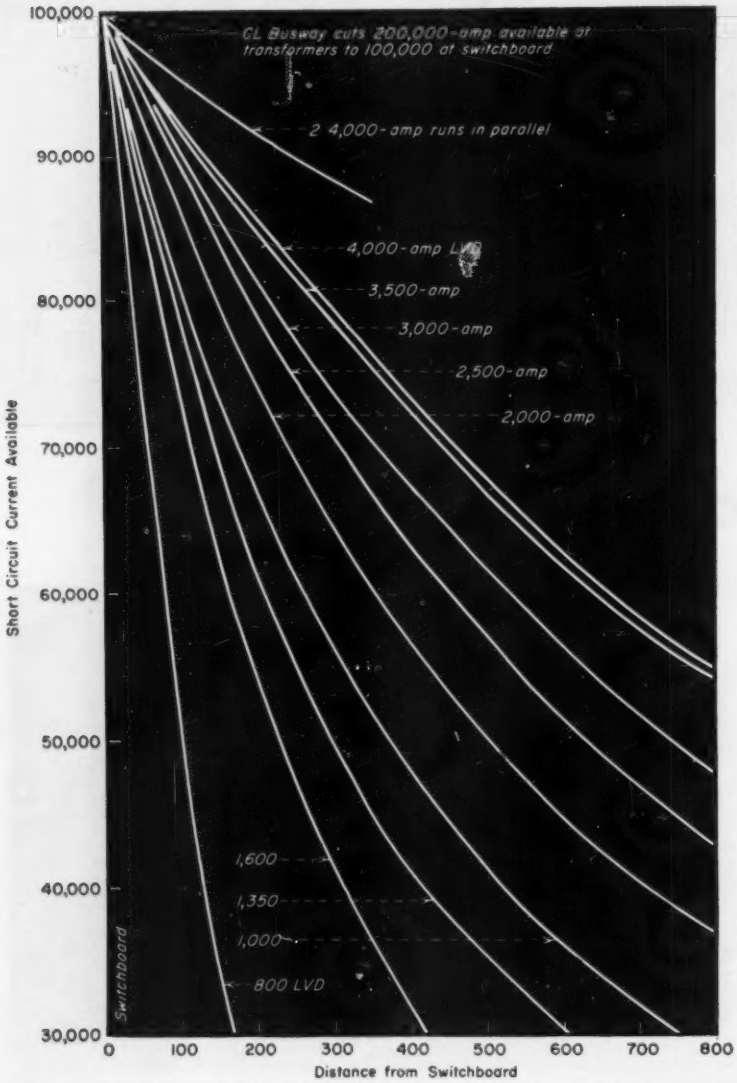


FIG 4—SHORT-CIRCUIT CURRENT (rms asymmetrical) available on feeder busways is shown on the curves above as a function of the distance from the switchboard

switchboard, current limiting busways were used to connect the stubs with the main switchboard.

Four runs of 3-phase, 4-wire current-limiting busways, conservatively rated 4,000 amp with extra thermal capacity for future growth, start at the four 480/277-v network stubs. Each is about 42 or 50 ft long and runs to the main switchboard. The required length of current-limiting busway was determined from the curves in Fig 3.

The current-limiting busway includes taped copper (or aluminum) bars, 2-in. thick, arranged in widely spaced phase groups to produce high reactance. In each phase the taped bars are on ¾-in. centers. They are completely enclosed in a ventilated aluminum housing 7⅛-in. deep by 29-in. wide for the 4,000-amp size.

Reactance Values High

Although this current-limiting busway has the same physical appearance as low-voltage-drop feeder busways, its performance characteristics are radically different. It provides reactance values 8 to 23 times those of standard low-voltage-drop-type feeder busways. In some ratings a 10-ft run of current-limiting busway offers more reactance than 200 ft of the low-voltage-drop-type busway in the same rating.

The current-limiting characteristics of the busway is obtained through a relatively large geometrical mean distance between phase groups. Impedance of this 4,000-amp, current-limiting busway is 0.0004 + j 0.0042 ohms per 100 ft on a line-to-neutral basis.

An important feature is the use

of special transposition straps which tend to reduce ac resistance by forcing currents to divide uniformly among the bars in parallel.

High-reactance, current-limiting busways are particularly effective at transformer stubs or at the point where service enters a building. It should extend to the switchboard so that standard circuit breakers and bus bar structures can be used in the switchboard without fear of excessively high short-circuit forces. Were they not used in the Coliseum, bus bars in the main switchboard would need bracing against stresses of short-circuits up to 186,000 amp. Air circuit breakers for such short-circuit duties would then have to be considered for the switchboards, and these, if available, would certainly be very expensive.

Regulation a Problem

With the short-circuit level reduced to a usable value in the main switchboard, the need remains for low-voltage-drop feeder busways to maintain good voltage regulation. This holds especially for long runs.

The 40-ft switchboard has four 5,000-amp main air circuit breakers, one for each run of current-limiting busway. Each has an interrupting rating of 100,000-amp rms asymmetrical. Also incorporated are four sets of 5,000-amp current transformers for Con Edison meters and an additional set for other metering and relaying. The 19 feeders busways are protected by individual air circuit breakers. In the main switchboard the cascade arrangement obtains.

Some busways leaving the switchboard are shown in the isometric drawing. A total of 19 runs of low-impedance busway, rated 800 to 8,000 amp, go out to different parts of the Coliseum building. In places the ceiling is almost hidden with busways. The low-voltage-drop-type feeder busways are the ventilated type.

Bus Bars Near 30 Miles

The bars are interlaced, ¾ in. apart, and are connected ABCABC-ABC, etc, this interlaced arrangement achieving exceptionally low values of resistance and impedance. Bus bars are ¼ x 2-in. aluminum, and an estimated 30 miles of them have been installed.

As short-circuit levels range from 100,000 amp near the switchboard, to about 35,000 amp at the ends of some runs, feeder busway had to be designed to withstand these currents. Tests at the Philadelphia development laboratory proved them capable of withstanding the forces during a 100,000-amp rms asymmetrical short circuit.

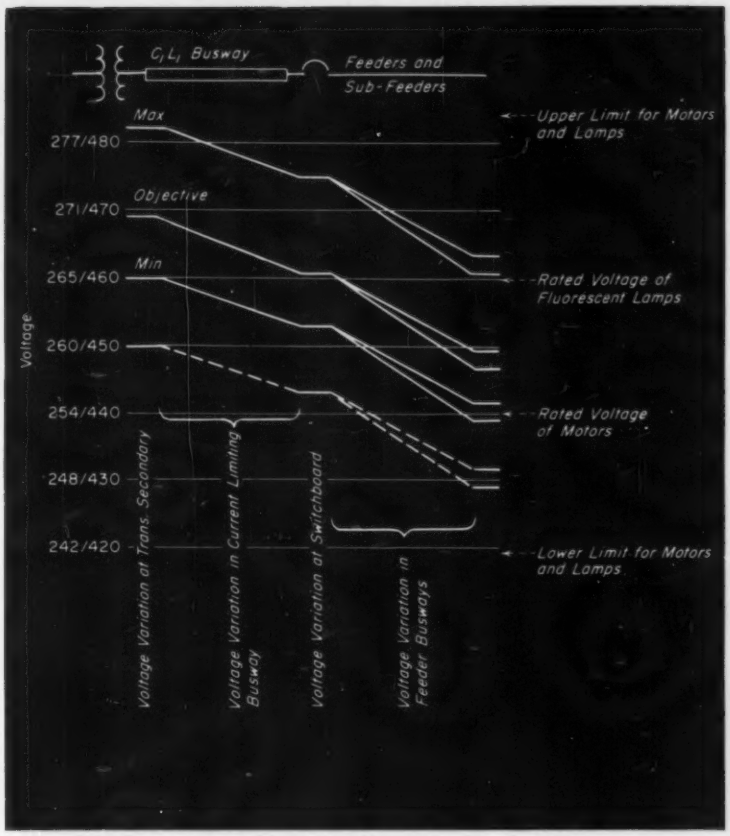


FIG 5—VOLTAGE REGULATION CURVES show voltage in building is never greater than 480 v nor less than 420 v, limits for satisfactory operation of equipment

Regulation Investigated

Feeder busway runs as long as 776 ft made the problem of voltage regulation seem, at first, almost insurmountable. Trial calculations indicated difficulty in achieving voltage regulation below the voltage drop recommended by the New York City Code authorities. Voltage regulation in the entire building, including the primary system and transformer bank, was thoroughly investigated.

Con Edison made a study at the secondary network stubs. A voltage of 270 (468) v was established as the normal objective with a 278 (482)-v maximum and a minimum of 460 v. In an emergency, with one transformer out of service, voltage might drop to 260 (450) v.

From these voltages at the network stubs, voltage drops in the current-limiting and feeder busways were subtracted. Preliminary regulation curves, similar to Fig 5, were drawn. An attempt was made to design the system so that voltage at any point in the building would never be more than 480 or less than 420 v. Within these limits most utilization equipment operates satisfactorily.

In some runs, however, the busway ampere rating was raised considerably above load requirements to cut voltage drop. The 4,000-amp run to the office switchboard, for instance, had to be doubled. Two 4,000-amp busways in parallel, having an effective rating of 8,000 amp, did the job. But this is an extreme example of busway size and ampere rating being dictated by voltage regulation rather than by load requirements.

Fuses Limit Let Through

The Coliseum's system exemplifies a new concept of electric power distribution; it makes use of current-

(*Continued on page* 160)

Fig 1—Tilted Blade Design

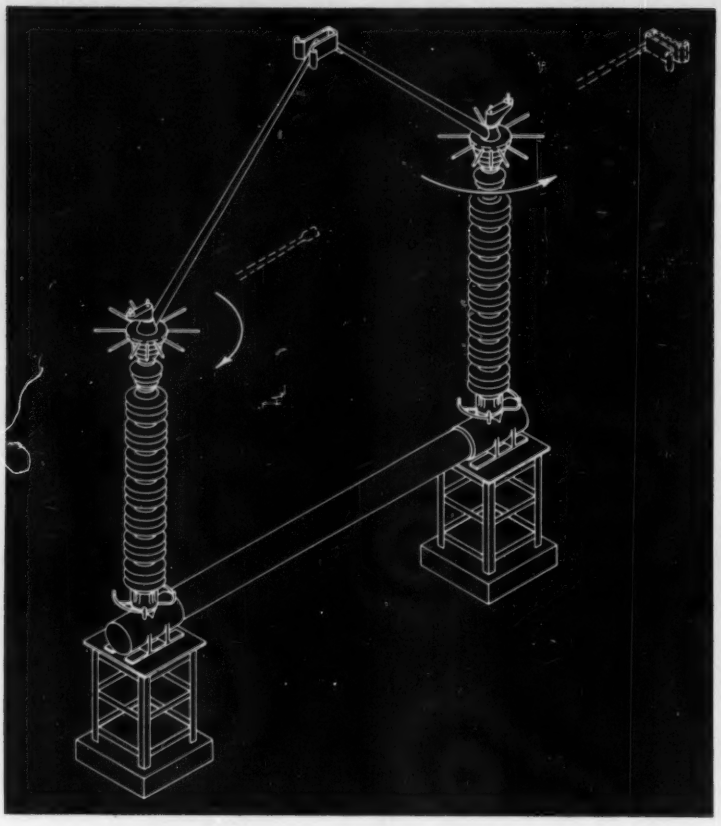
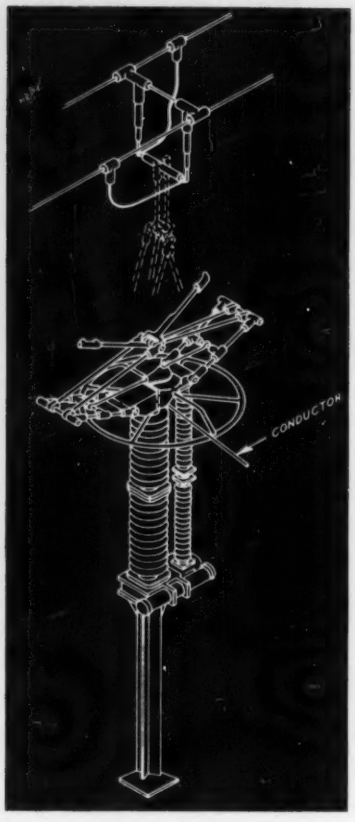


Fig 2—Pantograph Switch



Study of European Designs Indicates that . . .

Switches Offer Substation Savings

SUBSTATION Design

Horizontal-break, pantograph designs from abroad can be combined with American for space and structure economies

S. C. KILLIAN, Chief Engineers, Delta-Star Electric Division, H. K. Porter Co, Chicago, Ill.

The horizontal-break disconnect switch has been used for many years on European installation 220 kv and above, but recently the pantograph type has come into considerable use. The vertical-break switch is still the American choice.

A variation of the European design, shown as Fig 1, is used at a 380-kv Swedish station. It has blades tilted 45 deg to gain more clearance from the adjacent phase. But the usual design, whose blades are parallel to the base, is widely used in England and France.

In France the double, horizontal-break switch is accepted for 220-kv applications.

Italy and Germany like the pantograph switch for 220 and 300 kv. This type, shown as Fig 2, has one stationary stack. The other stack rotates, raising and lowering the pantograph to make and break the connection on a cable bus of bundled conductors.

A variation of this, with the jointed arm shown in Fig 3, is used at lower voltages and at voltages up to 300 kv.

The American type vertical-break switch, shown in Fig 4, has sturdy construction, few moving parts, is driven positively, has fully controlled blade, and has good ice and corrosion breaking ability. It is easy to adjust and to proof against radio noise and corona. It has wiping contacts using very high pressures and has no braids. It is adaptable to the higher continuous currents and high momentary currents in American practice.

European designs have few of these features. Moreover their cables must be strung accurately for proper switch contact and even when so strung the cables are subject to temperature changes and wind deflection. They are nevertheless more economical in first cost, ground space, and steel.

(*Continued on page* 88)

Fig 3—Jointed Arm Switch

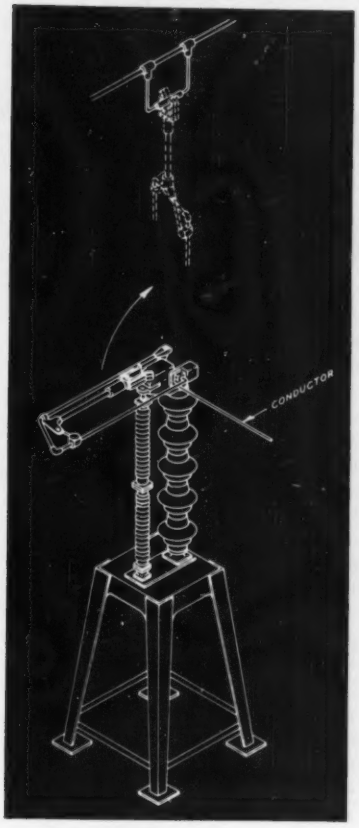


Fig 4—American Type Switch

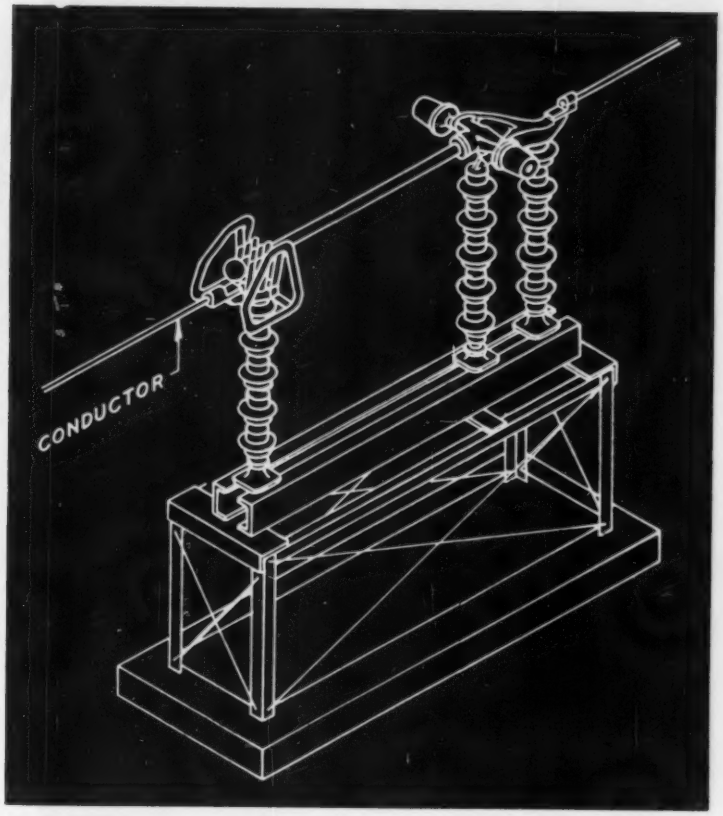


Fig 5—Vertical Break Design

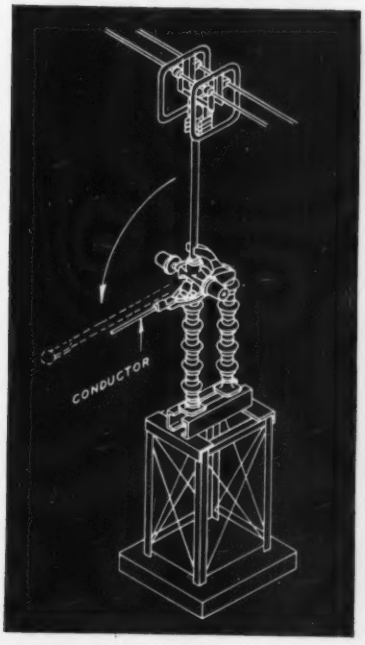


Fig 6—Rigid Contact Design

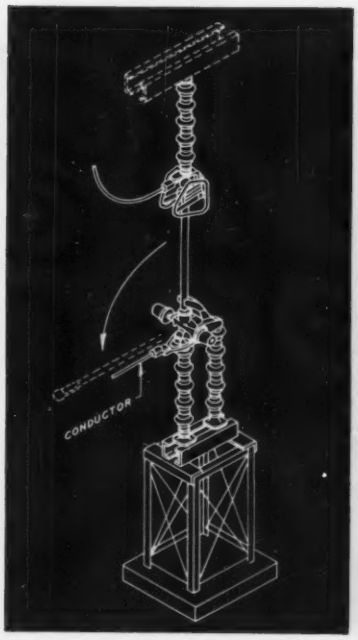


Fig 7—Double Throw Switch

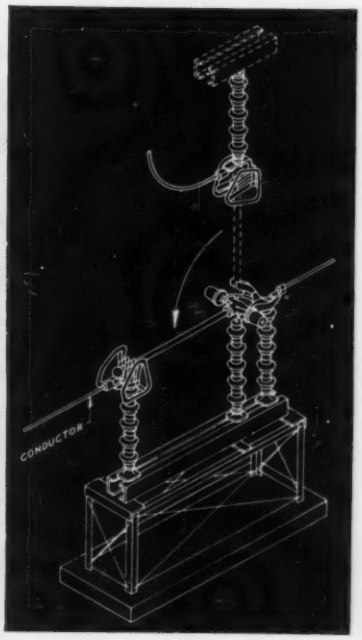


Fig 8—Substation With Vertical Switch

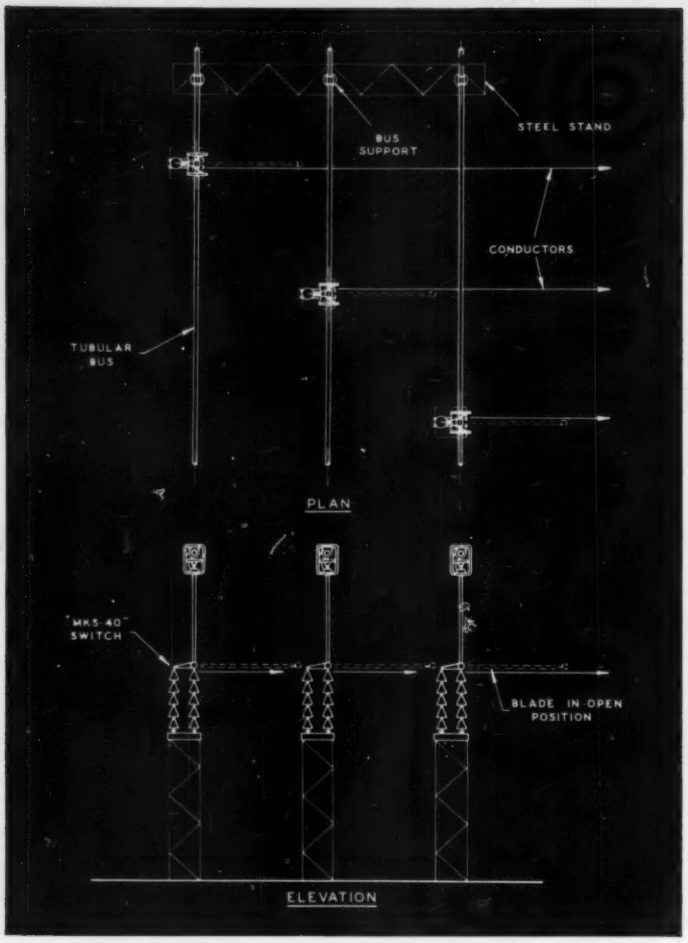
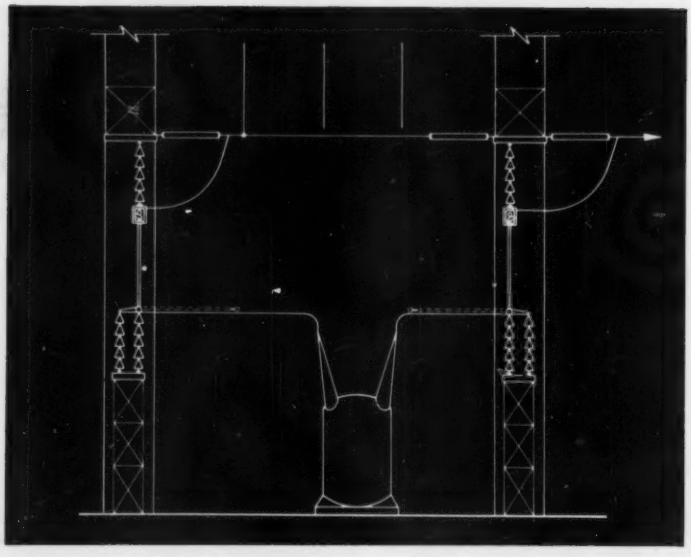


Fig 9—Disconnect Switch Application



The center-break switch in Fig 1 lacks the ground and structural steel saving of the switches in Figs 2 and 3. But it has many of the advantages common to vertical-break types.

On the other hand, this model has only fair ice-breaking ability and depends on the cable or bus to hold the terminal pad in position.

Although the vertical-break switch is not the most economical in first cost, it is the most adaptable to severe American duty; and its maintenance is low. As labor costs are high in this country, installation and maintenance time, as well as outages, must be kept to the minimum.

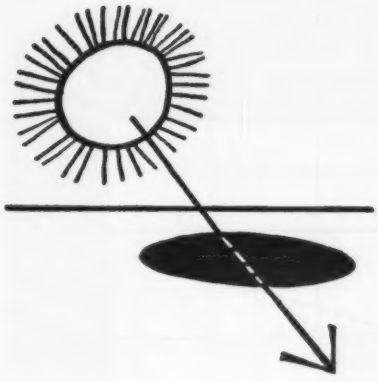
A vertical-break switch, designed to combine the good features of European and American models, is shown in Fig 5. It is arranged in the same manner as the pantograph switch. The blade is closed in the vertical position and open when horizontal. It incorporates the engineering, design, and testing of the present vertical-break switches. Furthermore it affords the ground and structural savings.

As American utility engineers have little enthusiasm for cable-mounted contacts, the switch's contacts can be mounted on the rigid bus of a ground-mounted station. The long spans, however, would make this impracticable on applications above 230 kv. Yet it might be economical at 230 kv.

The arrangement in Fig 6 presents possible ground and structure savings at a high-voltage installation and an alternative to those engineers who dislike contacts mounted on cable. Although insulator stacks are no more than those in the standard vertical-break switch, the configuration allows compression of the substation layout.

This design suggests the possibility of a double-throw switch of the type in Fig 7. But the design cannot be used as a disconnect or by-pass switch because the circuit is momentarily interrupted in moving from contact to contact.

But it offers the option of using one blade position as a grounding contact by replacing the stack with a grounded member. For the necessary blade motion, an insulator rotation of almost 180 deg may be needed. This eliminates the usual lever drive on the insulator stack as a lever cannot conveniently be driven through a semicircle. A gear arrangement at the base bearing, with rotating shafts between phases, can replace the usual reciprocating pipes.



A Special Report:

The Heat Storm Goes Underground

- **New York Tells What Happened When the 1955 Heat Storm Hit Brooklyn . . . . Page 90**
- **Philadelphia Finds Ducts Overheat, Load Factors Mount as Room Coolers Change Load Curves . . . . . Page 94**
- **Detroit's Growing Summer Load Sees Downtown Feeders Approach Limits . . . Page 96**
- **Chicago Prescribes Temperature Surveys to Prevent Cable Failure Epidemics . Page 97**
- **Industry Turns to Soil Research to Guide Underground Design . . . . . Page 101**

DAN BRAYMER, Managing Editor

Today heat storms are having a profound effect on power systems. Their influence stems from mutual and cumulative effects of weather and weather-sensitive load on system equipment. The problem is further compounded as ability of system equipment to handle the resulting load is itself influenced by the weather's effect on air and earth temperature and moisture.

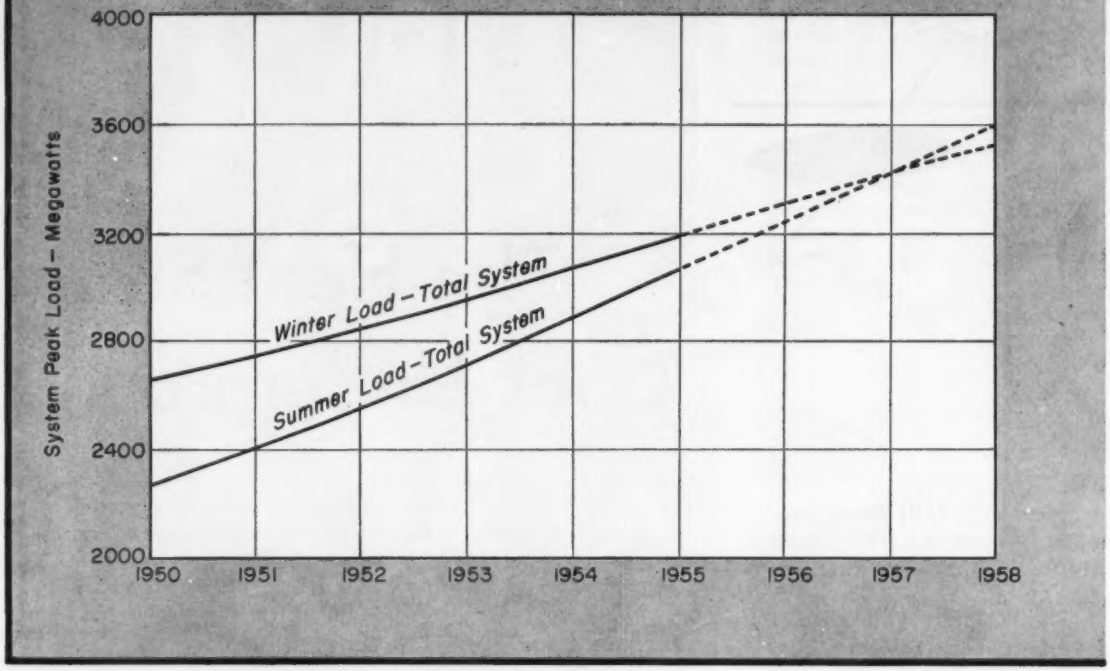
How overhead distribution systems were affected by heat storms of 1953 and 1954 was told in a special report in Electrical World of Jan. 9, 1955, and subsequent articles.

Last summer The Heat Storm Went Underground for the first time on some systems. On the following 15 pages Electrical World presents its second special report on heat storms. This one brings together the experiences and recommendations of power company engineers who have studied heat storm effects on underground distribution systems.

Outstanding among their conclusions are these:

- Today, rising costs are putting a premium on ability to load underground systems economically. Lack of knowledge of the heat dissipation characteristics of soil can result in higher than necessary investment in underground systems. Under heat storm conditions it may permit overheating of cable and reduction of life.
- Research is needed—and has in fact been started—in the underlying phenomena which control heat dissipation characteristics of soils surrounding underground cable lines.
- While time remains, underground distribution systems must be prepared for bigger summer loads and for heat storms of the future. Circuit loadings need study to be sure they have the capacity needed for summer peak load periods.
- Cable, duct-bank, and soil temperature surveys play a vital role in establishing the thermal capability limits that must be the basis for putting underground systems in readiness for future heat storms.
- Failing this—in the words of one utility engineer—"another heat storm may find so many duct banks thermally unstable that relief by transfer of load may be impossible. Temperatures may then reach the point where cables fail immediately. When this occurs, the load must be transferred to other cables which may also be operating above allowable temperatures due to the heat storm."

Fig 1 — Con Edison Summer Load Is Approaching Winter Load



New York: What Happened When . . .

1955 Heat Storm Hit Brooklyn Area

- 1955 summer had the hottest, driest July on record
- Sustained high temperatures brought marked increase in load
- Cable loading soared at time when load capability was lowest
- Epidemic of cable faults hit Brooklyn area 27-Kv feeders
- Bulk of failures were on cable installed before 1940

C. T. HATCHER, Division Engineer, Consolidated Edison Co of New York, Inc, New York, N. Y.

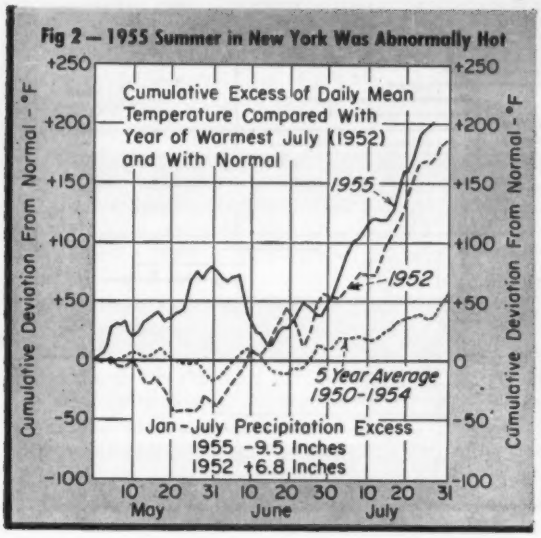
Transition from a winter to a summer peak load is being experienced by many electric utility companies, among them Consolidated Edison Co of New York, Inc.

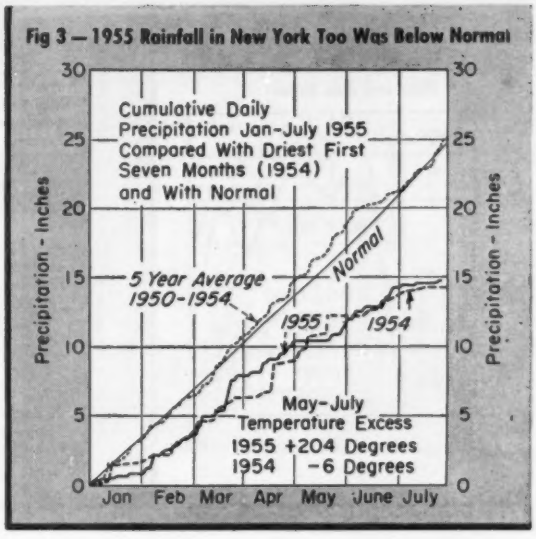
This shift, brought about mainly by the increase of air conditioning load, finds cable system load carrying capability reduced some 10 to 15% below winter values. This decrease results from the higher summer earth temperatures and the longer hours of peak load duration (higher daily load factors).

High daily temperatures, such as were experienced in Con Edison territory last summer, result in marked increase in system load. They also have the effect of increasing to some extent the temperature of the earth surrounding underground conduit systems. When such increased system loading follows unusually dry periods, the dissipation of heat from the underground cable systems is further restricted as a result of increased thermal resistivity of the soil.

A study of Figs 2 and 3, which show data pertaining to temperature and precipitation conditions in New York during the first seven months of 1955, indicates that precisely such a severe condition was being established.

Beginning at the end of June and continuing throughout July and the first week of August, the 1955 heat wave brought a prolonged spell of hot weather with some 17 days with daily highs ranging from 90 to 98F. Many





of these days had mean temperatures exceeding 85F, abnormal for this area. July was the hottest on record, with a mean temperature of 79.7F as reported by the Battery Park Station of the United States Weather Bureau. This is 5.1F above the normal mean temperature for July.

The effect of such hot weather in increasing cable system loadings, at a time when load capabilities are lowest, is shown in Fig 4. It compares loads on the Brooklyn area 27-kv feeder system for a 94F day with those for an 80F day. Note that proportionately loads are up during the period from midnight to 8 AM as well as from 8 AM through the day.

Cable Failure Epidemic Starts

Starting at 8 PM on July 7, Con Edison began to experience an epidemic of cable faults on its 27-kv distribution feeder system in the Borough of Brooklyn, which was to send failure rates for this system skyrocketing and demand many manhours of activity on the part of field and staff forces before operations returned to "normal" several months later.

The 27-kv distribution feeder system, that spreads out from the Hudson Avenue generating station, consists of 73 feeders supplying areas in Brooklyn and Queens. Feeders are routed to the load areas through 7 main outlet systems containing from 8 to 12 feeders each. The cable is 3-conductor, 500 MCM or 350 MCM size. The 500 MCM size is preponderant in the main outlet runs. Total cable length is of the order of 700 miles. Approximately 54 miles lie in the area adjacent to the station where the major troubles were experienced. This area will be referred to as the "Hudson Avenue Area."

The three low-voltage network areas are supplied over 56 feeders and the radial 4-kv substation load over 17 radial feeders. Total load from this station during the summer of 1955 was of the order of 600 MW. Major portion of this was network load.

The smallest network area is supplied by 13 feeders, and the largest by 24 diversified among the seven outlet systems. Network supply systems are designed to allow for the simultaneous outage of any two closely associated feeders (a "second contingency"). Normal second contingency experience indicates that (a frequency of) top emergency loading of any one feeder will occur every five to seven years. Contingencies involving more than two closely associated feeders are rare and may require reduction of customer load.

During July a series of multiple outages were experienced that at times seriously reduced feeder supply to the Brooklyn network areas. The major contingency periods are shown in Fig 5.

It will be noted, from Fig 5, that the major outage period in the first of these multiple contingencies occurred Friday morning, July 8. Four feeders, out of a group of nine closely associated feeders supplying the eastern portion of the West Brooklyn network area, were out of service during the start of the morning heavy load period. By 2:21 PM conditions reverted to a second contingency. Maximum temperature for the day was 86F, following several days in the 80's subsequent to much hotter weather. In this respect loading conditions on July 8 were favorable.

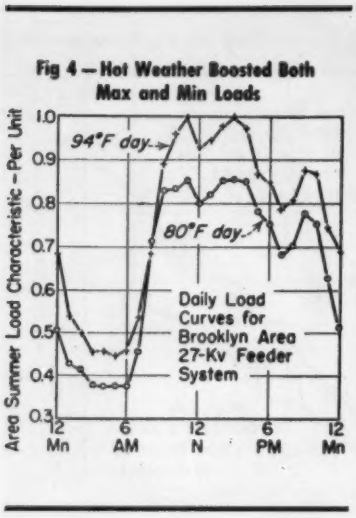
Another four-feeder outage occurred on Tuesday, July 19. It reverted to a third contingency at 9:54 AM with another feeder being restored to service at 12:28 PM. Daily high temperature was 91F following several days in the 90's.

A third multiple-contingency during July, a five-feeder contingency, occurred on Saturday, July 23, with the day's high of 96F following temperatures of 96F and 97F respectively. At the start of the day's load period one feeder was restored to service followed by a second feeder at noon, leaving three feeders out of service during the remainder of the day's heavy load period.

Transformer Load Checked

Throughout the multiple contingency periods, loadings on network transformers were checked. Where overloads were found, supplemental cooling measures were employed such as transformer manhole flooding, spray cooling of transformers, and installation of blowers.

During the first (July 8) multiple contingency period, appeals were made to customers in the affected area by radio, television, newspaper bulletins, and direct contact, asking



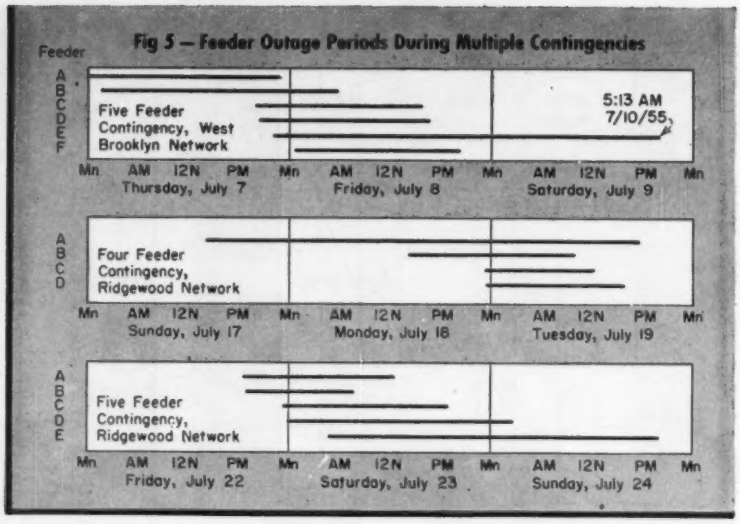


Fig 5 — Feeder Outage Periods During Multiple Contingencies
Feeder
A B C D E F
Five Feeder Contingency, West Brooklyn Network
5:13 AM 7/10/55
Mn AM 12N PM Mn AM 12N PM Mn AM 12N PM Mn
Thursday, July 7
Friday, July 8
Saturday, July 9
A B C D
Four Feeder Contingency, Ridgewood Network
Sunday, July 17
Monday, July 18
Tuesday, July 19
A B C D E
Five Feeder Contingency, Ridgewood Network
Friday, July 22
Saturday, July 23
Sunday, July 24

their cooperation in curtailing energy use to prevent serious overloading of secondary mains, distribution transformers, and 27-kv feeders remaining in service. During the subsequent multiple contingencies, customers were contacted directly and asked to reduce load.

Appeals for load reduction evidently were heeded as the remaining feeders in general did not exceed their prescribed summer emergency ratings. Meantime, all available means were used to expedite the location of faults and replacement of faulted cable sections.

Routine temperature surveys had been made in the Hudson Avenue Area during January 1955. They indicated satisfactory levels in all but a few sections where the temperatures were high. Work to expose these sections for investigation was underway when the July 8 multiple contingency occurred.

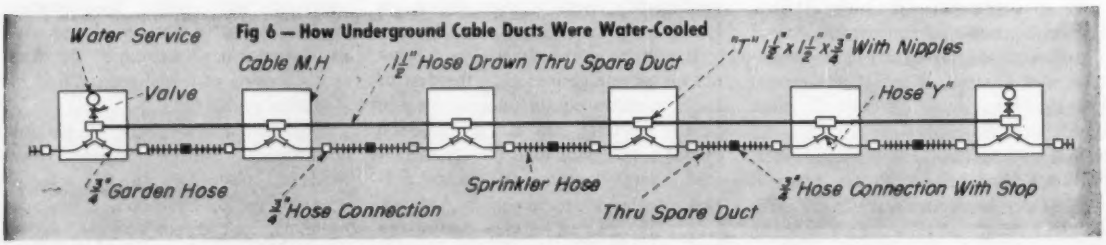
Examination of cable samples from the feeders involved in the first of these three contingencies (all three occurred within a two week period) revealed the primary cause of failure to be a thermal breakdown of insulation. Paper tapes were embrittled and showed signs of associated ionization. Wax formation was pronounced in many cases. Laboratory tests on examples taken from faulted feeder sections showed excessive dielectric losses in the insulation. It was then evident that a major problem was faced of reducing cable operating temperatures to an acceptable level.

Duct Temperature Surveyed

Pending study of possible means of cooling duct banks artificially, a series of duct temperature surveys were made beginning with sections where major trouble had developed. These surveys, in which duct bank temperatures were measured at 20 ft spacings, subsequently were extended to the entire Hudson Avenue Area. Results indicated temperatures ranging from 34C to as high as 86C at one "hot-spot." An idle duct temperature of 55C is the maximum summer level considered acceptable in heavily loaded duct banks. Duct bank temperatures above 55C were found to be limited in general to a few sections in each of four of the 7 outlet systems and to a longer run in a fifth system.

A number of emergency cooling systems was used to reduce temperatures in the duct banks during the period of the trouble. As a first expedient, portable blowers, exhaust fans, and dry ice were used to reduce high manhole temperatures. Subsequently, two types of water cooling systems were installed. One involved a system in which sections of garden "soaker hose" were laid in centrally located empty ducts and tapped at intervals to a main "header hose" which was connected at several points to a city water main. The second system employed a perforated pipe installed below the pavement on a thin bed of crushed stone leaching water through the soil around the duct bank. Fig 6 shows the method used for the soaker hose system.

Several blower systems were also installed. Air was discharged into a manhole with its duct sections sealed off in one direction and exhausted in



another manhole a number of sections away. Intervening manholes were filled with dry ice which was replenished at regular intervals. Use of dry ice was also extended to a number of manholes without supplementary cooling systems.

Use of dry ice in manholes required precautionary methods before workmen could enter manholes. This necessarily hindered some of the work being carried on in the area.

Although only a minor third feeder contingency occurred in August, cooling activities were continued throughout the month on the basis of duct bank temperature measurements made on thermocouples previously installed at points where high duct temperatures had been disclosed by the earlier temperature surveys. Some cooling activities were terminated at the end of August. Others were continued through September as dictated by a continuing check of duct bank temperatures.

Suit Cooling to Site

Types of cooling used had to be fitted to the site. It was necessary to consider hindrance to traffic. And noise in residential neighborhoods had to be avoided in so far as possible. Many operational factors involved make it difficult to assess the relative effectiveness of one cooling system versus another. But it can be said that both water cooling and air blower systems were effective in reducing the duct bank temperatures to acceptable levels.

In addition to the failures which contributed to the multiple contingencies shown in Fig 5 other failures were experienced in the Hudson Avenue Area and in the remainder of the Brooklyn 27-kv system. Fig 7 shows the total number of failures both in and beyond the Hudson Avenue Area for 1955 compared with the record for 1954 and 1952. The first seven months of 1954 were the driest on record for the New York area. July of 1955 was the warmest July on record, as previously shown in Figs 2 and 3.

The relationship of 1955 cable failures in the Hudson Avenue Area to the age of cable is shown in Fig 8. As indicated 28 out of a total of 34 failures on the 500-MCM size occurred on cable installed in 1940 or earlier. Only about 40% of the total 500-MCM cable in service in the area had been installed prior to 1941. The 350-MCM size was installed essentially prior to 1933 so that all of the failures of 350-MCM cable occurred on cable of that vintage. The 1954 failures showed similar characteristics.

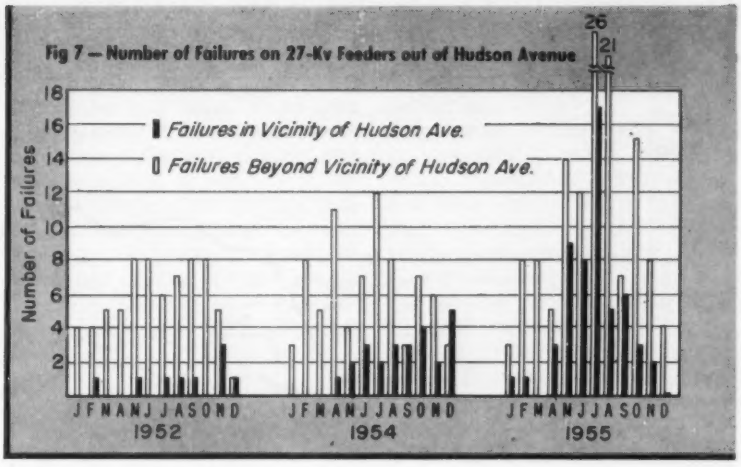


Fig 7 — Number of Failures on 27-Kv Feeders out of Hudson Avenue
Failures in Vicinity of Hudson Ave.
Failures Beyond Vicinity of Hudson Ave.
Number of Failures
J F M A M J J A S O N D
1952
1954
1955

From the very start of the epidemic of cable failures during July there was evidence of thermal breakdown. As a result early steps were taken to withdraw unfaulted cable sections from the field in selected age groups for investigation of power factor and dielectric loss characteristics. Typical power factor characteristics are shown in Fig 9 for cables in these age groups. These values represent average values of different samples of various manufacture.

The general program for correcting the conditions considered responsible for the excessive failure rate involves a number of steps:

1. Reducing the number of cables in the main outlets.

2. Replacing cables having high dielectric loss.

3. Enlarging or replacing small manholes.

Plans were approved to establish:

1. Three new outlet systems in the Hudson Avenue Area to bring the total to 10 and to reroute into these systems feeders from the existing heavily loaded systems.

2. The maximum number of feeders will be limited to eight in any system.

3. It was also decided to replace all 350-MCM cable which is generally 25 to 30 years old.

4. On the basis of the characteristic curves shown in Fig 9 a considerable amount of the older vintage 500-MCM cable also will be replaced as its power factor exceeds the system design value of 6% at 75C which is used in determining current carrying capacity of the feeders.

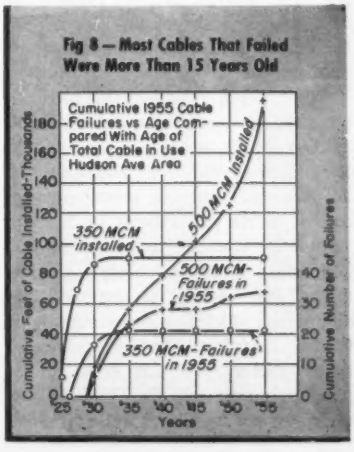
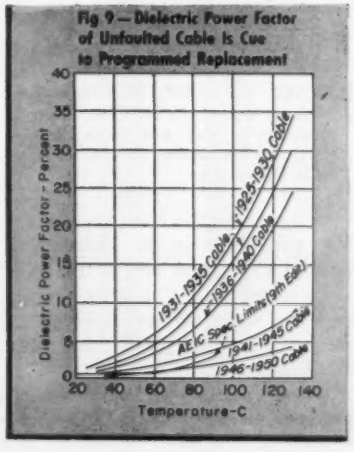
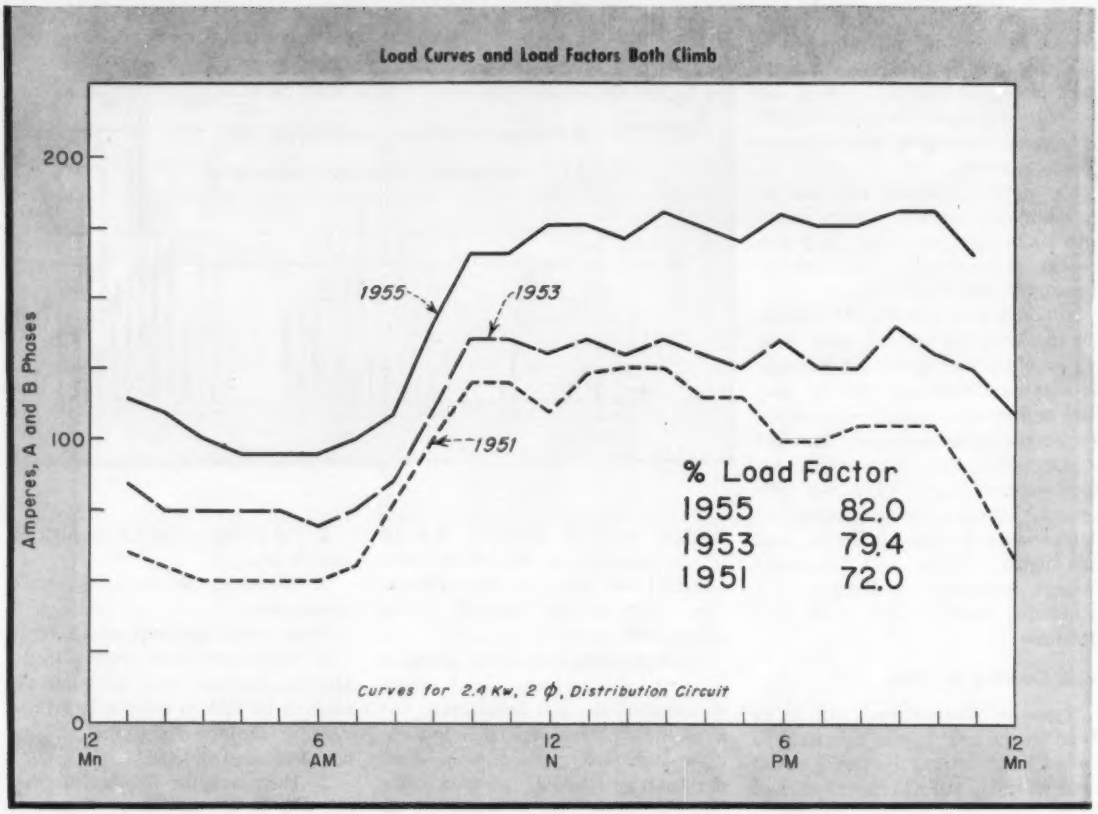


Fig 8 — Most Cables That Failed Were More Than 15 Years Old
Cumulative 1955 Cable Failures vs Age Compared With Age of Total Cable in Use Hudson Ave Area
500 MCM installed
350 MCM installed
500 MCM-Failures in 1955
350 MCM-Failures in 1955
Cumulative Feet of Cable Installed-Thousands
Cumulative Number of Failures
Years





Philadelphia: Ducts Overheat, Load Factors Mount as . . .

Room Coolers Change Load Curve

HOWARD L. DAVIS, JR, Engineer-In-Charge, and **C. R. NORTH,** Engineer, Transmission and Distribution Section, Electrical Engineering Division, Philadelphia Electric Co

Last year for the first time summer Mva peak load on the Philadelphia Electric Co system topped the previous winter peak. The 1955 summer peak load was 2,345 Mva (1,920 Mw); the previous winter peak 2,265 Mva (2,000 Mw).

Growth in summer load has been paced by the air conditioning load. In 1955 there were an estimated 132,583 room air conditioners on the system. This is about 5½ times the number operating in 1951. About 70% are installed in residences. Load wise these room coolers represent a total of 163,000 kw. Altogether, by 1955, connected load of air conditioning on the Philadelphia Electric Co system was 384,800 kw.

The greatest impact of this load has been felt on underground distribution circuits serving residential areas where large concentrations of room coolers are installed. Because earth temperature is at its yearly peak in the late summer, the underground system has less load carrying ability than in the winter. As long as summer loads do not exceed 85% of the winter loads, winter conditions are the controlling design factors. But this is no longer true on most of the Philadelphia underground system. Ratings must now be based on summer conditions.

To illustrate the effect of this changing load pattern, consider the case of an actual duct bank on the Philadelphia system that last summer contained nine 2.4-kv, 2-phase distribution circuits and two 13.2-kv 3-phase double-cable substation supply lines. This bank reached excessive temperature during the 1955 heat storm due to this altered load pattern. Its maximum empty-duct temperatures had in fact, increased each year from 1951 through 1955 (See chart).

The unusually hot and dry weather of the 1955 summer, coupled with the increase in residential air conditioning due largely to room cooler units, caused this duct bank temperature to soar to 80C with very little advance warning. Rearrangement of the circuit and supply line loading was necessary to start the temperature downward.

Investigation of conditions brought

to light several interesting facts:

1. None of the cables had been carrying an ampere load exceeding its rating.

2. Thermal resistivity of earth adjacent to the duct bank was calculated using actual hourly data on each of the 2.4-kv and 13.2-kv cables in the duct bank over five weeks. It was found that the thermal resistivity of the earth rose sharply with the duct temperature and that it dropped back toward normal in the same manner. This indicated that the heat dissipated by the duct bank was enough to drive away any moisture in the earth, resulting in a condition of thermal instability. If load on these cables had not been rearranged promptly, it is expected that duct bank temperature would have continued to rise causing thermal failure of the cables.

Load Factor Increased

3. Load factor on all these distribution circuits exceeded the design value of 65% established by previous experience. These higher load factors were caused largely by the concentration of room air coolers in this area. The 24-hour load curves for one of these circuits on typical summer days in 1951, 1953, and 1955 are shown. Load factor increased from 72% to 82% over these years. It is apparent from these curves that there has been a general flattening of the load curve. Moreover, an increase in the minimum loads is evident. Another effect of the change in shape of the load curve is the deterioration of diversity between the cables in the duct bank. Each of these factors increase the heat that must be dissipated from the duct bank and are accentuated when hot and dry weather prevails.

Such conditions as these have not been occurring regularly or for a long-enough time to produce an increase in the cable failure rate on the 2.4/4-kv distribution system. This is due to the fact that while the underground cables suffer life loss and damage under such elevated temperatures, ultimate failures may occur at random times. Moreover, they may never be directly attributable to a specific period of over-temperature operation. It is to be expected, however, that the damage inflicted on cables by operation in the 80C duct bank will result in an increased number of failures in the future.

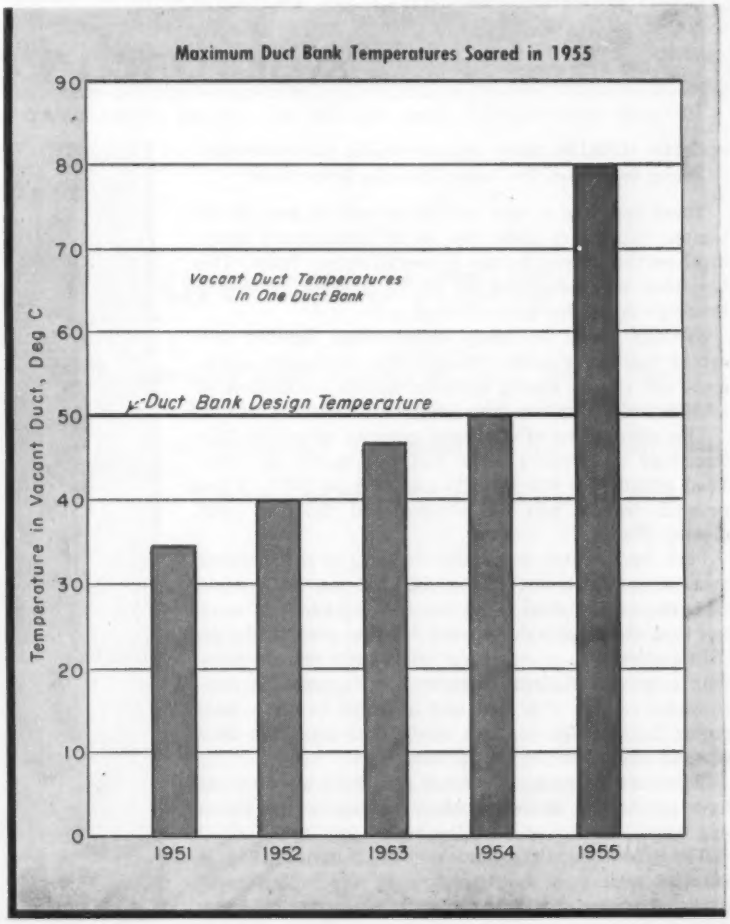
The danger lies in maintaining present policies of duct bank loading through the next few years during which more nearly normal summer weather may prevail . . . and then facing another heat storm. Under such circumstances so many duct banks may become thermally unstable that relief by transfer of load may be impossible. Temperatures may then reach a point where cables fail immediately. When this occurs, the load must be transferred to other cables that may already be operating above allowable temperature because of the heat storm conditions.

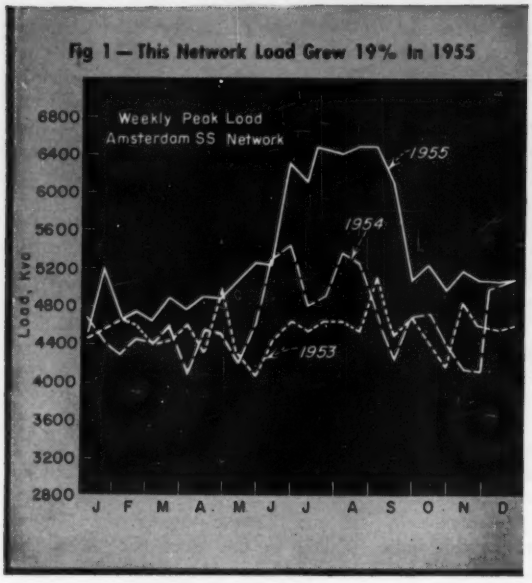
Philadelphia Preventive Plan

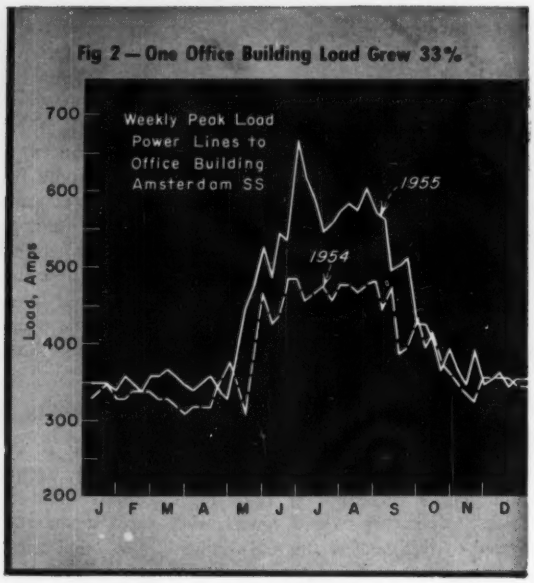
An annual duct bank temperature survey has been made each year in late August and early September when earth temperature is at a maximum. Such monitoring of temperature indicates which duct banks need relief so that corrective measures may be applied. While this general survey will continue as in the past, experience during 1955 indicates that temperatures of the more heavily loaded duct banks should be measured earlier in the summer in order to detect incipient thermal instability.

To prepare its underground system for increased distribution loads in the future, Philadelphia Electric Co is now going forward with the changeover from 2.4-kv 2-phase to 4-kv 3-phase distribution. This will provide more distribution capacity and reduce heat losses in the cables. In addition, capacitors are being installed on distribution circuits to add kilovars to the system. This also reduces cable load.

Information on the change in heat transmission characteristics of the earth and the effect of the higher load factors of the air conditioning load indicates that the number of cables installed in one duct bank must be reduced to avoid an epidemic of thermally unstable duct banks during long, dry, hot periods like the 1955 summer heat storm.







Detroit: Growing Summer Load Sees . . .

Downtown Area Feeders Approach Load Limits

WARREN MUELLER, Senior Engineer, Planning and Project Engineering Department, The Detroit Edison Co, Detroit, Mich.

There has been a very marked growth of load in the summer because of installation of air conditioning equipment on the Detroit Edison system in recent years. This has been especially true in the large office and store buildings in the downtown Detroit area.

Summer loads on many underground feeders now exceed the winter peaks. Because firm ratings on equipment are lowest, during summer months installation of additional capacity has been frequently necessary.

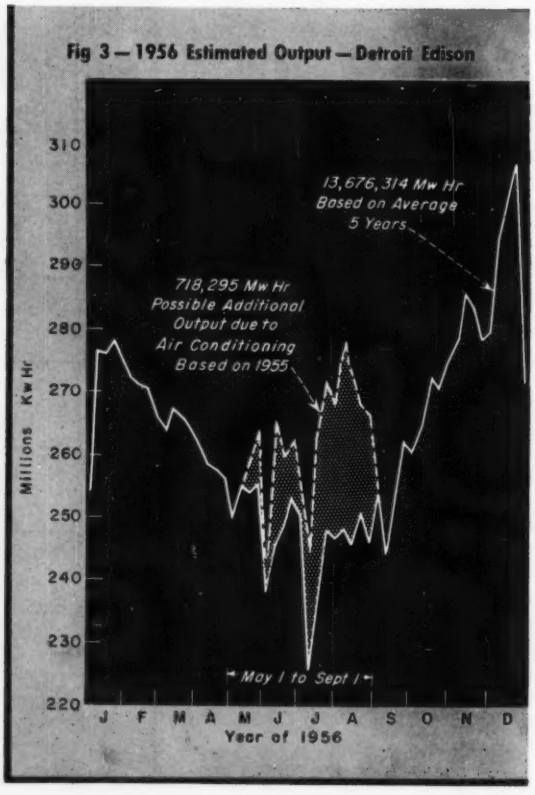
This requirement of additional capacity on one of DE's three-feed ac network areas will be reached in 1956. Load growth was 8% in 1954 and 19% in 1955. Three network feeders will be installed and the load area divided (Fig 1).

Peak load of one large office building in this network area increased about 33% in the past year. To avoid cable overload, a third power line is being added to carry this load and to provide capacity for load growth (Fig 2).

In another area of stores and office buildings, served by four loop power circuits, which are approaching their allowable ratings, it is necessary to install two new loop power lines by the summer of 1956 to meet the load demand and allow for future load.

Thus far underground conduit and cable temperatures have not been a serious problem because of DE policy of routine checking of cable loading.

The growth in air conditioning load during 1956 is expected to increase system output by 718 million kwhr during the months of May to Sept.



THREE-MAN CREW MAKES TEMPERATURE SURVEY. DRIVER DIRECTS AND RECORDS DATA. OTHERS MAKE READINGS

Chicago Tells How Temperature Surveys . . . .

Prevent Cable Failure Epidemics

TODAY: As summer loads increase and heat storms threaten, Commonwealth Edison monitors factors affecting underground capability by surveying duct, duct bank and soil temperatures

RESULT: There has been no rash of cable failures to date

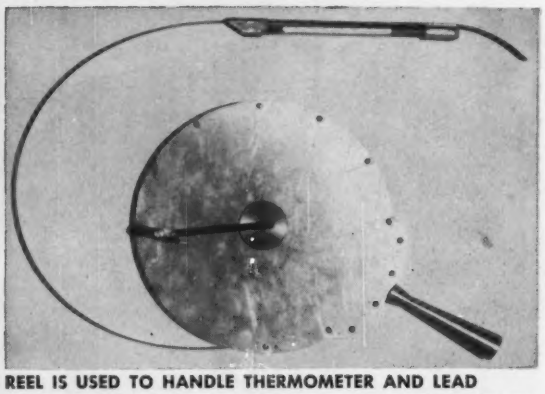
C. A. BAUER, Supervising Design Engineer and
D. D. NAGLEY, Engineer, Commonwealth Edison Co, Chicago, Ill.

Many power systems today are undergoing a change in the shape of their load curve. In the past, peaks have occurred in the winter on these systems, and summer loads have been quite low in comparison. But in recent years these low summer loads have been creeping up. In the summer of 1955 the peak load on the Commonwealth Edison system exceeded the previous winter peak for the first time.

On the underground system this means that cables and duct banks are heavily loaded at a time when soil conditions, because of high temperature and low moisture content, are least able to dissipate the heat generated by these loads. This limits load capability of both cables and duct banks, particularly where the soil has a low conductivity, where duct banks cross, or where there are steam mains or other heat producers near the duct bank.

To keep track of these factors affecting the underground system load capability, Commonwealth Edison Co has for several years made extensive temperature measurements of ducts, duct banks, and soil surrounding duct banks. Last year 4,400 duct temperature measurements alone were made. These investigations, it is believed, have kept summer loads from catching the company too much by surprise. So far, they have prevented any rash

THERMOMETER ON 25-FT STEEL LEAD INSERTED IN DUCT



REEL IS USED TO HANDLE THERMOMETER AND LEAD

RECORDER IS USED IN HOTTEST LOCATION IN LINE

of cable failures, and it is felt will prevent cable failure epidemics from occurring without warning in the future.

Four types of temperature surveys have been conducted on the underground system. They are: 1. general, 2. longitudinal, 3. special, and 4. fireproofing.

Types of Temperature Surveys

1. General Surveys . . . General temperature surveys have been made in all important and heavily loaded conduit runs at least once during each summer some time between June 1 and Oct. 1. All conduit in and immediately adjacent to generating and substation properties and along routes on lines of 33 kv and over are included. Empty duct temperatures are measured near cables carrying the heaviest loads in at least one direction out of each accessible manhole along the route.

The indicating thermometer used to measure duct temperatures is fitted into a metal "shoe" which is connected to one end of a 25-ft steel tape. The tape is wound on a reel to facilitate fast installation and removal from the duct. Indicating thermometers rather than the maximum reading variety are recommended because they do not require "shaking down" before reading. But speedy removal from the duct is important as the temperature must be read before it changes materially.

A temperature survey is usually made by three men using a four-door automobile. The driver directs the work and records the data. The others ride in the back and handle the temperature reels and gear for opening and closing the manholes. Usually eight sets of thermometers are installed and manhole covers closed. At least 20 min is required for the thermometers to attain the temperature of the duct. Then manhole covers are reopened, and thermometers removed and read as quickly as possible.

Such other information is recorded as; depth of conduit below surface, height and width of the conduit, position of the water level in the manhole in relation to the conduit, number of cables, thermometer position in the duct bank, and kind of paving.

These data serve as a check on the system and are invaluable in planning the installation of additional cables. Analysis reveals overloaded sections of conduit, if any, furnishes information needed in recommending changes.

Where necessary, a temperature recording meter, above, is installed at the hottest location along the route of each high voltage line and in other conduits having high temperatures. Charts are changed once a week. They furnish a continuous check on the system and serve as a basis for special ratings requested for important lines from time to time.

2. Longitudinal Surveys . . . Longitudinal temperature surveys are of value where excessive temperatures may exist too far in the duct to be measured by a general temperature survey. This is desirable when there is an indication that excessive temperature may have caused a cable failure at the location. It also serves as a check on locations where crossing steam lines or other sources of heat are likely to affect the carrying capacity of the conduit and cables.

The tests are conducted with a specially-constructed thermocouple cable approximately 400 ft long with

TWO MEN READ GROUND TEMPERATURE FROM POTENTIOMETER CONNECTED TO THERMOCOUPLE TERMINAL BOARD

thermocouples every 20 ft. The cable has terminal boards mounted in end bells on both ends of the cable. Thermocouples may be read at either terminal board.

It is usually desirable to measure the temperatures at 5-ft intervals. This necessitates moving the thermocouple cable several times after installing. An interval of at least one hour is necessary after the test cable is installed before the first set of readings is taken and also after moving the cable to a new position.

3. Special Surveys . . . Where unusually high duct temperatures are found during the general survey, special surveys are made to determine what kind of relief is necessary. Temporary relief can be obtained by flooding the conduit or reducing the load on the cable or both. Special surveys may be in the form of longitudinal surveys, general surveys, or both. Additional information, such as location of fire hydrants and the best way to get water for flooding, is a part of the special survey data.

4. Fireproofing Surveys . . . Along high-voltage cable lines, fireproofing surveys are made to detect the magnitude and extent of excessive dielectric losses, wherever possible. First step in the survey is to feel the cables where they are accessible in manholes, trenches, on the walls of stations, and in switch houses. "Hot spots" so located are investigated by obtaining actual temperatures with mercury thermometers or thermocouples. Comparing measured temperatures with calculated values determines the extent of the "hot spot." Corrective measures, if necessary, are then recommended.

Ambient earth temperatures at the depth of the conduits are essential for analysis. These temperatures, taken at the time of the surveys, are obtained from thermocouples installed at various depths and several locations about the system.

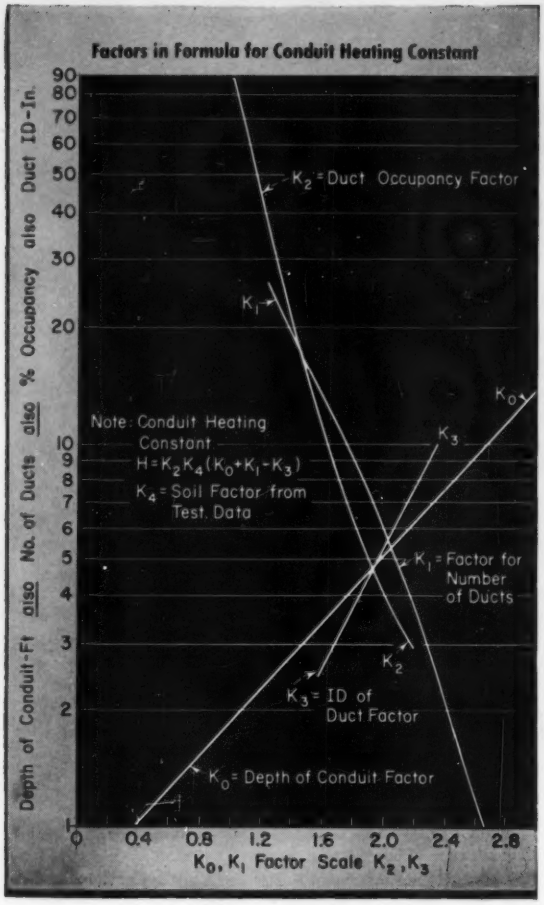
Recording thermometers are also installed at three locations to obtain a continuous record that may be used as a guide in estimating the earth temperature at any time for the other locations. Atmospheric temperature variation affects the ground temperature to a depth of about 20 ft. Thermocouples are usually installed at intervals to a depth of 15 ft.

Special Terminal Board Used

The thermocouples are usually made of insulated No. 16 copper-constantan duplex wire twisted together and dipped in solder. A turn of Neoprene or rubber tape is applied over the junctions. The other ends of the thermocouples are connected to the correct position on a numbered terminal board. Brads are set in the terminal board on which the connections are made. Each wire is coiled around a brad for several turns. Stubs about 0.5 in. long are formed in this manner. These serve as terminals to which potentiometer leads are connected for temperature measurements.

The terminal boards are mounted in metal boxes. Readings are best taken with a portable direct-reading, self-compensating cold junction potentiometer. When calibrated for the type of wire used, an over-all accuracy of ± 0.1C may be expected for the range of temperatures involved.

Direct reading mercury thermometers are used almost entirely in general survey work. The scale is 0 C to 60 C,



covering a total distance on the thermometer of four inches. In locations where the duct temperature exceeds this range, 10 C to 110 C thermometers of the same length are used by the survey crews.

Kennelly Formula's Use Limited

The Kennelly formula gives satisfactory results in calculating the surface temperature rise of a *buried* pipe or cable dissipating heat because the surface of this heat source is relatively uniform in temperature. Tests have also proved that the temperature rise thus calculated, when superimposed on the ambient ground temperature, gives the true final temperature.

The Kennelly formula, however, does not lend itself to *conduit* temperature calculations for several reasons:

1. The temperature is measured inside the conduit and not on its surface.

2. The surface temperature is not uniform around the conduit periphery.

3. The heat generated in a conduit is not uniformly distributed within the conduit.

4. A degree of ventilation is possible in a conduit, either by circulating air or water, and thus the conduit temperatures are subjected to more seasonal climatic changes.

Any system used to calculate conduit temperatures or to analyze field temperature survey data must be relatively simple to use and yet reveal any abnormal temperatures that exist. Moreover, the analysis should indicate to what extent each of the several factors is contributing to the temperature rise so that mitigating or corrective measures can be effectively applied. Such a system has been worked out and the following equation derived:

$$H = H_t (K_o + K_1 - K_3) K_2 K_4 \text{ Deg C/W/ft of conduit.}$$

In this expression:

K_o, corrects for the depth of the conduit.

K_1, corrects for the number of ducts.

K_2, corrects for the conduit occupancy.

K_3, corrects for internal diameter of the duct.

K_4, corrects for soil conditions.

H_t, corrects for seasonal variation in climatic conditions. For shallow conduit of short length the variation from winter to summer may be from 1.00 to 1.35. For conduit 4 ft or more below the surface and several hundred feet in length the effect is negligible.

Factors Carefully Determined

In order to simplify conduit temperature problems, the various factors involved in the equation were first determined and plotted (left). First step in a case is determination of all of the factors with the exception of the soil factor "K_4" for say a 12-duct conduit having 3½-in. ducts, 100% occupied, with its center line 4 ft below the surface. The Kennelly formula is used for the basic line of attack. The soil factor is then determined by back calculation from test data. Factors for other conduit configurations and sizes were then determined on a relative basis.

The value of K_3 requires some engineering judgment. For example, a 20-duct conduit with four equally loaded cables is considered 20% occupied if all four cables are grouped in one corner of the conduit. On the other hand, if in this conduit one cable is placed in each of the four corners it is considered as 100% occupied. Other cable arrangements require similar interpretations.

Remedial Measures

Flooding manholes and conduit by running water through the ducts along the cables is the most effective temporary relief for reducing conduit and cable temperatures. Soaking the ground over the conduit is also quite effective and is sometimes done where feasible. Forced air is effective for short runs of less than 200 ft.

Permanent methods of reducing conduit and cable temperatures depend upon the economies of the particular problem. Some of the methods available are:

1. Increase in size of the conductor.

2. Reroute some of the cables to other conduits.

3. Install more than the standard number of ducts and be satisfied with a lower percentage of permissible occupancy.

4. For conduits in soils of poor thermal characteristics, install the conduit deeper if characteristics improve with depth.

5. Install the conduit as shallow as permissible if the soil characteristics do not improve with depth.

6. Replace the soil around the conduit with soil of better conductivity.

The analysis of the carrying capacity of the conduit is particularly useful as a basis for future use. Any increase in expected load factor should be incorporated to avoid future overloading of the conduit.

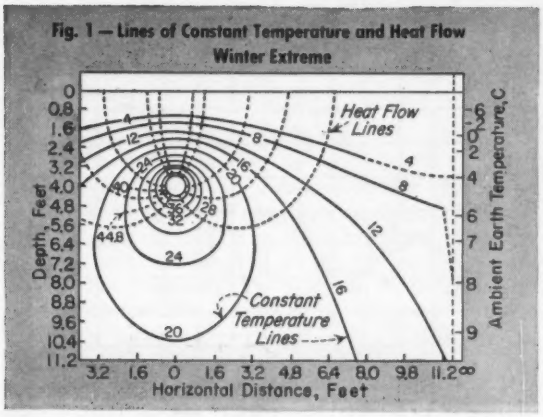


Fig. 1 — Lines of Constant Temperature and Heat Flow
Winter Extreme

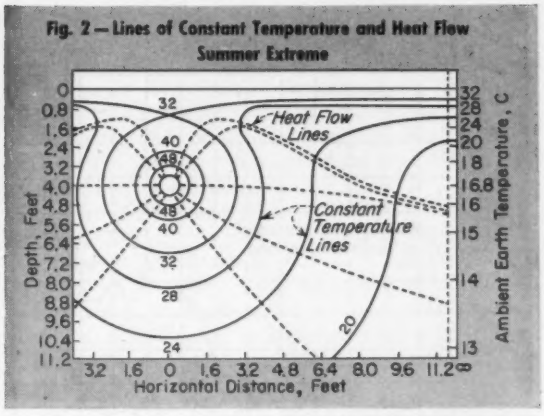
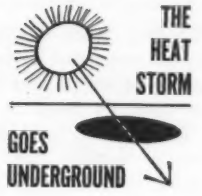


Fig. 2 — Lines of Constant Temperature and Heat Flow
Summer Extreme

To Guide Underground Design . . .

Industry Turns to Soil Research



TODAY: Rising costs put premium on ability to load underground systems economically. But lack of knowledge of heat dissipation in soil can limit load capacity and boost investment

RESULT: The industry is spending $65,000 for soil research

R. W. BURRELL, Chairman, Steering Group for Soil Thermal Resistivity Research Project also Chairman, AIEE Soil Thermal Resistivity Research Project Subcommittee 14

Lack of basic knowledge of the heat dissipation characteristics of soil has hampered economic loading of underground power cable systems—and so added unnecessarily to their cost—since the first cables were installed late in the 19th century.

Today this lack of knowledge is becoming even more expensive. Rising costs have emphasized the need to hold investment in underground cable to the practical minimum that will provide load capacities required by our expanding economy. The comfortable margins once provided by over size cables are not so easily justified now as they were formerly.

But the load that cable can safely carry and stay within the limits of allowable temperature rise depends on the ease with which heat generated by load current can be dissipated through the soil surrounding cable systems. In some cases thermal resistance of the soil may account for more than half the allowable temperature rise and correspondingly limit load capacity.

Consequently, lack of knowledge necessary to evaluate the thermal resistance of this heat flow path through soil can result in higher than necessary investment in cable systems. It can also result in overheating of power cables and shortening of their life. Both these errors are costly in terms of capital investment. Just how costly is evident from the total industry investment in underground transmission, distribution, and utilization circuits.

Elimination of these costly and unnecessary errors, then, is the potential premium to be won from better understanding and knowledge of the heat dissipation characteristics of soil surrounding underground cable lines. It is the specific aim and objective of an industry-sponsored research project that was begun officially on August 1, 1955. The project was initiated by the AIEE Committee on Insulated Conductors. But it also has received widespread support from cable users and suppliers both in this country and Canada. Effort is being made also to correlate this study with similar activities in Europe.

How this project came into being, the support it has received, and the plans of operation can best be outlined by a series of questions and answers of which the first might well be—

Q—How Have We Gotten By So Far?

As might be expected, empirical methods have prevailed in the absence of factual knowledge. Such methods were used to establish current loading levels for cable in duct based on field temperature measurements, and for all practical purposes they were in reasonably close agreement.

In the early 1930's the industry established standard "duct heating constants," based on an extensive survey of field conditions. These constants, designated by the symbol "H" and referred to as the NELA-EEI duct heating constants, are weighted average values. As such,

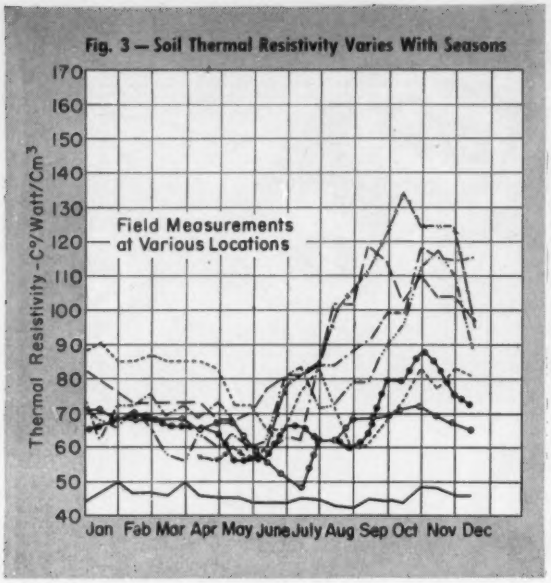


Fig. 3 — Soil Thermal Resistivity Varies With Seasons

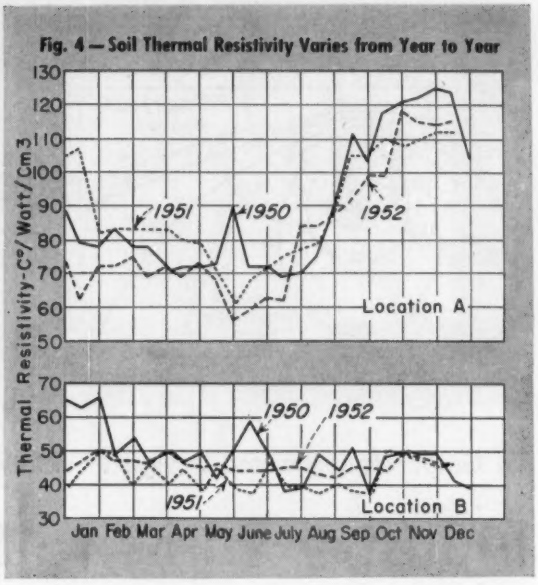


Fig. 4 — Soil Thermal Resistivity Varies from Year to Year

therefore, they do not take into account the varying nature of the soil, its moisture content, or the effect of depth below the surface. On the *average*, they produce acceptable results.

Q—Why Is a New Approach Needed?

Sporadic attempts to rationalize duct heating constants on a mathematical basis in the past have been without much agreement. With the increased use of pipe cable systems, a particular need was felt to establish such a mathematical basis for calculating the temperature rise occurring in the earth in a manner which could be applied to duct cable systems and pipe cable systems. This need was faced, for example, in making comparisons between low-pressure oil-filled cable and pipe-type cable for high-voltage installations.

A basic mathematical approach for buried cable lines was provided by Dr A. E. Kennelly as early as 1893. This formula expresses the temperature rise through the earth path as a function of the heat loss of the cable system, its geometry, and the thermal resistivity of the soil. More complicated formulas have since been developed for treating the transient temperature rise, but these too revert to a form of the Kennelly formula for the steady-state condition.

Q—Why Not Use the Kennelly Formula?

The Kennelly formula was used as the basic method of calculating earth path thermal resistance in Europe where buried cable systems are standard.

The British made many studies in the laboratory on samples removed from the field. Unfortunately, it was found that these values of soil resistivity, when used in the Kennelly formula, gave temperature rises in excess of those observed in the field. As a result, a concept of "net" soil resistivity was introduced in that country which was taken as two thirds of the so-called gross or absolute resistivity values determined in the laboratory. Lack of agreement on the concept of the "two thirds' correction factor," which was interpreted as allowing for the compaction of the soil, contributed heavily to this country's delay in accepting the Kennelly formula as the basis for evaluating earth path resistance around conduit systems. The effect of underground water tables acting as sinks for the absorption of heat dissipated by underground cable lines created further confusion.

Q—How Was This Confusion Resolved?

Paralleling the increased use of pipe-type cable systems in this country, the AIEE Insulated Conductors Committee sought to establish a basic approach applicable to directly buried, pipe-type and in-duct cable systems and to explore related factors. These efforts reported in various AIEE Transactions papers since 1948 have illuminated the problem and cleared up misunderstanding as to application of the Kennelly formula.

Kennelly derived his formula for the temperature rise of a buried cable assuming that ultimately all heat dissipated is transferred to the earth's atmosphere. He treated the earth's surface as a base isothermal plane and considered the earth surrounding the heat source as being at a uniform temperature and of uniform thermal resistivity. In practical application the resulting heat field is superposed on the earth's normal seasonal heat field.

The nature of the overall heat field resulting from such superposition during periods of winter and summer extremes is shown in Figs 1 and 2 taken from a 1949 AIEE Transactions paper, by Neher. They represent the ultimate or steady state conditions assuming constant soil thermal resistivity. Full attainment of the ultimate temperature rise will be reached theoretically only after infinite time. In practice cyclic heat flow can be replaced by equivalent constant heat flow, and attainment factors can be applied in interpreting data of field tests which cannot be continued indefinitely.

Modifications to take into account varying thermal resistivity through the soil profile would be necessary for a true representation of the steady state heat fields shown in Figs 1 and 2.

Q—Why Is New Work Needed?

The Kennelly formula is derived on the basis of an assumed constant thermal resistivity of the soil. In practice soil resistivity is dependent on a number of factors which generally are far from constant throughout the soil profile. Soil resistivity for purposes of the Kennelly formula can be viewed as an overall equivalent or effective value, which while constant at any particular time, may, vary seasonally in some degree.

Taken on this basis, absolute measurements of soil resistivity determined in the laboratory still are unsatisfactory for use in the Kennelly formula unless properly related to field measurements. In effect, then, although use of a rigid "two thirds correction factor" applied to laboratory gross thermal resistivity determinations is not considered acceptable, adjustment still must be made to take into account varying thermal resistivity through the soil profile. Direct observations of effective thermal resistivity made in the field using actual cable systems, or thermal radiators for which the geometry of the heat field is known, must be used for final control checks.

Q—How Did Research Project Idea Begin?

The idea of a research study of this problem did not materialize suddenly. In 1947 the Cable Engineering Section of the Association of Edison Illuminating Companies (AEIC) appointed a working group to investigate heating characteristics of underground power lines. Field measurements of effective thermal resistivity were begun by several utilities at this time. By 1948 it was agreed that this activity should be transferred to the jurisdiction of the AIEE Insulated Conductors Committee.

Between 1948 and 1951, this committee studied various phases of the subject of current-carrying capacity of underground cable lines. Some of these studies, especially in connection with pipe cable lines, were blocked by insufficient fundamental knowledge of the thermal resistivity characteristics of the earth.

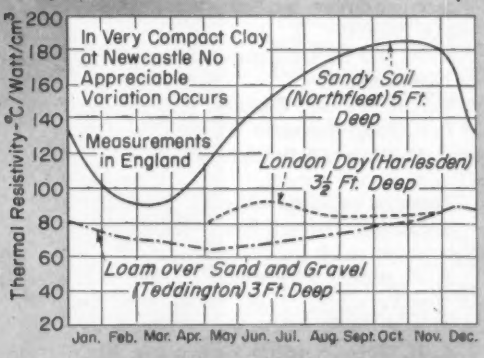
The British had done work in this field as mentioned, but there remained the stumbling block of the two thirds correction factor. Resistivity values in British technical literature varied over a wide range and were not well enough related to soil parameters for widespread use. Consequently, a task group to investigate this subject more thoroughly was appointed in 1951, with the author as chairman. But like the study of older duct heating constants, these studies too were of an empirical nature.

It became apparent that a better fundamental understanding was necessary. Field measurements made in essentially sandy soils showed characteristics illustrated in Fig 3. Essentially stable values are indicated seasonally for some locations, but others reveal wide seasonal variations. Data as in Fig 4 indicated that these different seasonal characteristics are essentially repetitive and appear to be characteristics of the soil types. The British, too, had found the same variations. Fig 5, taken from the 1938 AIEE paper, by Whitehead and Hutchings, shows the same two basic seasonal characteristics.

Early in 1954 the task group reported to the AIEE Insulated Conductors Committee that a fundamental research study was desirable and should be carried out by a university or by some other research unit. This study it was felt should seek a more basic understanding of underlying phenomena affecting soil thermal characteristics, such as:

1. The effect of granulametric composition of the soil particles.

Fig. 5 — Seasonal Variations in Soil Thermal Resistivity



At Northfleet and Harlesden Temperature Differences Were Measured From Sphere Surface to Base.
At Teddington Temperature Differences Were Measured Between Two Thermocouples Buried in the Ground 1½" and 20" Respectively From the Surface of the Sphere.
All Tests Carried Out With 9" Spheres.

Where the Money Came From

To carry on the research program at Princeton on heat dissipation characteristics of soils, the AIEE has received commitments totaling approximately $65,000 from the following sources:

Edison Electric Institute
Association of Edison Illuminating Companies
Engineering Foundation
Insulating Power Cable Engineers Association
The Hydro-Electric Power Commission of Ontario
Quebec Hydro Electric Commission
City of Los Angeles, Dept. of Power
City of Memphis, Dept. of Power
Anaconda Wire & Cable Co
Canada Wire & Cable Co
General Cable Corp
Northern Electric Co, Ltd
Okonite Co
Phelps Dodge Copper Products Corp
Phillips Electric Co, Ltd

Of the total contribution committed, the major portion was received from the two investor-owned utility associations, EEI and AEIC.

2. Soil moisture content.

3. Moisture migration tendencies.

4. Other influencing forces exhibited due to the physico-chemical characteristics of the various soil types.

Minimum cost of such an investigation was estimated to be about $60,000. The Insulated Conductors Committee quickly endorsed the recommendation of its task group. First steps were taken in the fall of 1954 to obtain official AIEE approval for financing and carrying out such a project.

The task group reviewed published work in this field and carried on correspondence with a number of research agencies. The nature, the duration, and the possible cost of a worthwhile program were discussed by some members of the task group with research personnel in a number of visits to potential research centers. These discussions finally crystallized into a definite project which was proposed to possible sponsors.

Q—Where Will the Research Be Done?

Subsequently a research agreement was established between the United Engineering Trustees, Inc, acting for AIEE and other sponsors and Princeton University, the research agent. A three year program was planned but the agreement was for a one year period with provision for two subsequent renewals.

The work will be carried out at Princeton in the Department of Civil Engineering under the direction of Dr Hans Winterkorn, professor of Civil Engineering and director of Princeton's soil physics laboratory.

Q—What Is the Scope of the Project?

Many basic phenomena need to be studied to provide a better understanding of the heat dissipation characteristics of various soil types. Specifically, some of these to which the industry would like to find answers are:

1. What are the fundamental factors which determine the effective thermal resistivity of various soil types?

2. What are the reasons for observed seasonal variation of effective thermal resistivity in some soils and not in others?

3. What are the factors which influence moisture migration, and what critical conditions "trigger" soil thermal instability?

4. What range of effective thermal resistivity values apply in various parts of the country or, more objectively, what values should be used for specific soil types? How should these values be adjusted for different depths of burial and for changes in climatic conditions?

5. What limitations must be observed in the operation of underground cable lines to insure stable soil thermal conditions?

6. What artificial means are practical for controlling the thermal behavior characteristics of various soil types?

7. What means can be established to relate findings of soil thermal resistivity properties to proposed or existing cable routes with a minimum of soil sampling, mechanical analysis, or testing of an extended nature?

Q—What Is the First Step?

The first step has been to make a thorough survey of previous work in the field. A fairly complete bibliography covering the field of soils and factors governing the thermal behavior characteristics of soils has been prepared. Along with this goes the organization of the mathematical tools necessary for the understanding and treatment of the fundamental phenomena and their possible simplification for engineering use. This part of the program has been completed also.

The next stage is to begin laboratory work with samples that represent different genetic soil types, structural and textural classes, variations in density and handling procedure, and variations in moisture and air content. Paralleling these studies, field studies need to be made in areas possessing soil types that bracket all the soil types of major practical interest to cable users.

The final stage would encompass evaluation of laboratory and field data and, it is hoped, will include the development of a practical method for classifying soils with special consideration of solid and organic matter content, critical heat rate, critical temperature gradient, rewetting characteristics, and resistance to moisture migration.

Q—What Results Are Expected?

Among the points to which the industry hopes to find practical answers, moisture effect is extremely important. Drying out of the soil around underground cable lines producing runaway temperature conditions is a phenomenon which has been experienced by more than one utility at various times. Although less dramatic, cable overheating produces a longer but nevertheless foreshortened cable life. Potential losses in investment can be appreciable in magnitude. Within the budget available it is hoped that the more important factors can be explored in detail and the direction pointed for clearing up others.

Two Committees Will Guide and Supervise the Project

General overall supervision will come from . . .

Steering Group for Soil Thermal Resistivity Research Project:

R. W. Burrell, Chairman, Consolidated Edison Co of New York;

Harold E. Cody, Cleveland Electric Illuminating;

L. E. Fogg, Kennecott Wire & Cable Co;

A. H. Kidder, Philadelphia Electric Co

Technical guidance will come from . . .

AIEE Soil Thermal Resistivity Research Project Subcommittee 14:

R. W. Burrell, Chairman, Consolidated Edison Co of New York;

A. S. Brookes, Public Service Electric & Gas Co;

F. H. Buller, General Electric Co;

A. W. W. Cameron, The Hydro-Electric Power Commission of Ontario;

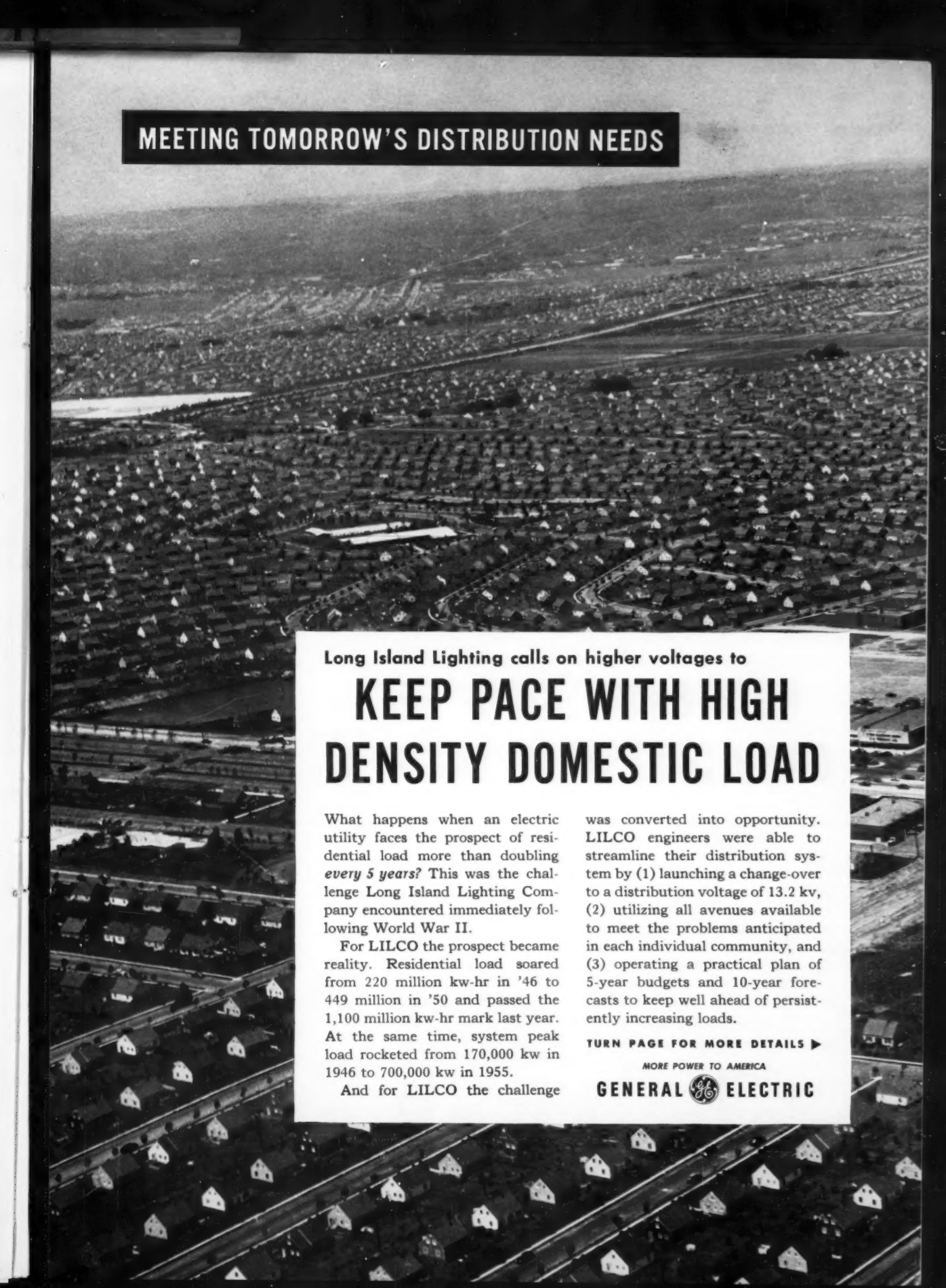
W. A. Del Mar, Phelps Dodge Copper Products;

L. F. Fink, Philadelphia Electric Co;

M. H. McGrath, General Cable Corp;

W. A. Sinclair, The Detroit Edison Co;

W. J. Wiseman, The Okonite Co



Long Island Lighting calls on higher voltages to

KEEP PACE WITH HIGH DENSITY DOMESTIC LOAD

What happens when an electric utility faces the prospect of residential load more than doubling *every 5 years?* This was the challenge Long Island Lighting Company encountered immediately following World War II.

For LILCO the prospect became reality. Residential load soared from 220 million kw-hr in '46 to 449 million in '50 and passed the 1,100 million kw-hr mark last year. At the same time, system peak load rocketed from 170,000 kw in 1946 to 700,000 kw in 1955.

And for LILCO the challenge was converted into opportunity. LILCO engineers were able to streamline their distribution system by (1) launching a change-over to a distribution voltage of 13.2 kv, (2) utilizing all avenues available to meet the problems anticipated in each individual community, and (3) operating a practical plan of 5-year budgets and 10-year forecasts to keep well ahead of persistently increasing loads.

TURN PAGE FOR MORE DETAILS ▶

MORE POWER TO AMERICA

GENERAL ELECTRIC

MEETING TOMORROW'S DISTRIBUTION NEEDS

MAXIMUM SERVICE CONTINUITY is assured by G-E distribution transformers. Above, W. O. Smith, Ass't. Vice Pres. & Mgr., Elec. Operating Dept.; C. Kiel, Jr., Ass't. Mgr., Elec. Oper. Dept.; and R. M. Grogan, Mgr., Meter and Distribution Engineering, all of LILCO, note clean arrangement of General Electric line transformer and triplex service. The secondary conductors shown here are aluminum.

LOW AND COMPACT design of G-E unit substation enabled LILCO to do attractive landscaping, keep local good will high, as discussed by W.O. Smith; F.G. Josberger, Distribution Engineer; C. Kiel, Jr., and R.M. Grogan.

Long Island

EXTRA FLEXIBILITY of G-E equipment is demonstrated by single-phase transformer with cabled secondary and services supplying residences. Streamlined design is explained by G.E.'s E. J. Bateman to Long Island Lighting's L. G. Colson and R. Hickson.

EXTENDED LIFE of G-E meters helps utilities cut maintenance costs. This bank of G-E meters in an apartment house holds attention of Long Island Lighting Company's G. R. Sullivan and W. A. Hickson, Jr.

MAGNETIC SUSPENSION and cyclometer register features in G-E I-55 meters are discussed by E. J. Bateman, G-E sales engineer, with LILCO's J. Dye (l), Superintendent—Meter & Test Section, and R. M. Grogan (r). New meter design assures straight-line accuracy to 100 amperes.

IMPROVED VOLTAGE CONDITIONS, helping systems carry more load, are two reasons for installing G-E capacitors. Above, G.E.'s M. Lennig (l) checks performance of 300-kvar G-E switch capacitor bank with LILCO's J. A. McDougall, and R. Hickson, Distribution Planning Engineer.

Lighting Co. activates long-range plans to expand distribution system capacity

Reliability of General Electric apparatus aids in boosting service continuity

The now-historic post-war home building boom on Long Island meant that larger and larger blocks of power would be needed. Even more important, this power must be made available at easily usable voltages for local distribution. Starting from there, Long Island Lighting engineers launched a program to raise transmission voltages from 66 to 138 kv and capitalized on the advantages of 13.2 kv for distribution. Result: during the record-breaking winter peak of 1955, more than 45 per cent of LILCO's total load was served economically and efficiently over the 13.2-kv lines.

To put such plans into action, LILCO decided to utilize the best equipment available. Much of this apparatus was selected from General Electric's complete line.

When you, like LILCO, specify G.E., you take advantage of the latest advances in apparatus design, construction and application. That's because G-E engineers are able to translate the trends and needs of growing systems as reported by G-E field personnel, incorporate newest materials and manufacturing techniques in producing them, and provide help in putting these advances to best possible use on your system.

And to help utilities keep service running smoothly, highly trained G-E service engineers plus a nation-wide network of G-E Service Shops stand ready to meet any and all maintenance and repair needs—day and night.

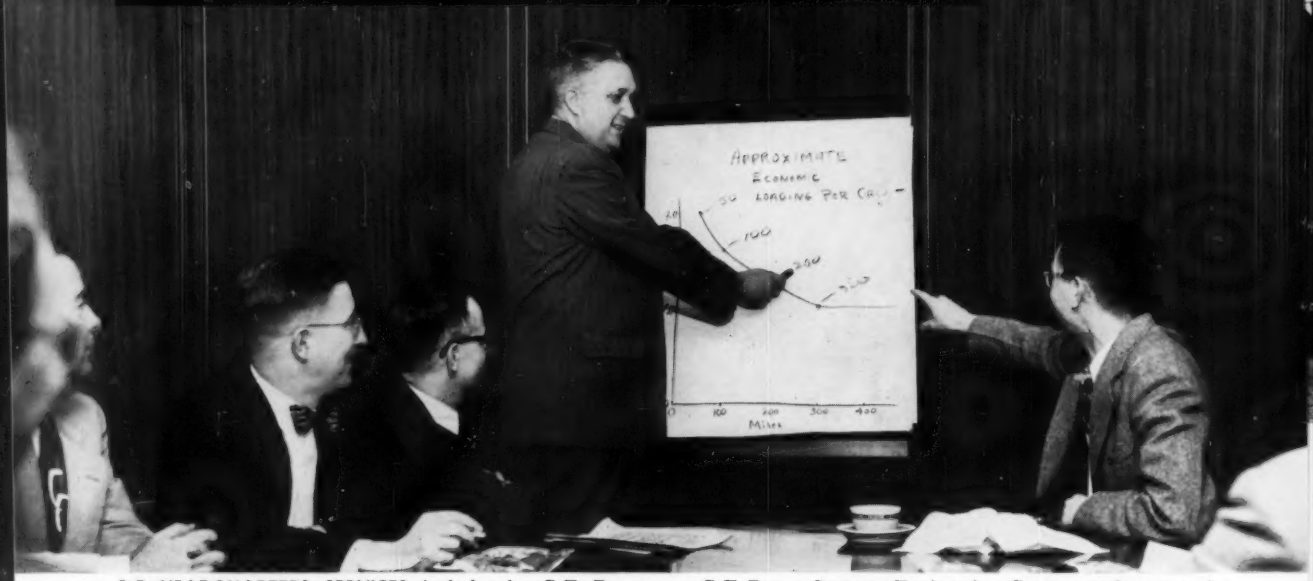
For full information on General Electric distribution equipment and distribution system services, contact your nearby G-E Apparatus Sales Representative, authorized G-E Agent, or G-E equipment distributor today. Or write General Electric Company, Section 303-1, Schenectady 5, N. Y.

TURN PAGE FOR MORE ON MEETING TOMORROW'S DISTRIBUTION NEEDS

MORE POWER TO AMERICA

GENERAL ELECTRIC

MEETING TOMORROW'S DISTRIBUTION NEEDS



G-E HEADQUARTERS SERVICES include the G-E Power Systems Engineering Course, the Electric Utility Systems and Practices Course, and board studies. Above, at the G-E Power Systems Engineering Course, engineers review basic approaches to system designs that will help step up system efficiency, improve consistency of service.

G-E Power Systems Engineering Course helps utilities plan for future with sound ideas

Part of General Electric's continuing program to assist electric utilities in meeting today's growing demands for electric power is the G-E Power Systems Engineering Course. In this course, promising young utility personnel are given the opportunity to study advanced electric utility system theory and practice. As a result, utilities are able to train men to incorporate latest ideas into system designs.

The full range of G.E.'s distribution system services includes headquarters system planners—district application and product engineers—extensive product development facilities—equipment installation and field service engineering—complete interflow of ideas. To the electric utility industry, these services offer assurance of maximum operating continuity, on-the-spot application help, greater equipment efficiencies, valuable help in system design and techniques.

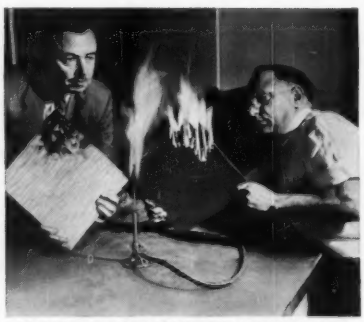
Get the full story from your G-E Apparatus Sales Representative. General Electric Company, Schenectady 5, N. Y.

MORE POWER TO AMERICA

GENERAL ELECTRIC

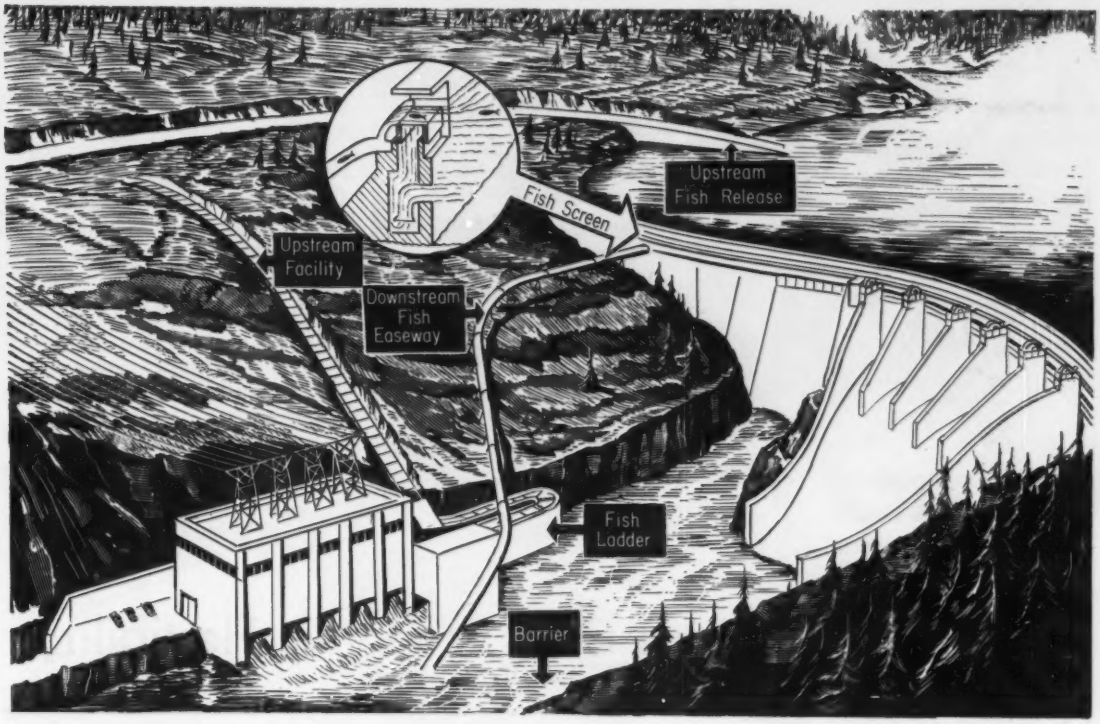
More Reasons Why It Pays to See G.E. About Distribution Problems

LOCAL APPLICATION ENGINEERS assist utility engineers with system designs, equipment-type selection, application problems early. Answers speed practical use of latest ideas, product advances.



GREATER EQUIPMENT RELIABILITY comes from tireless product development and research. Here flame-retardant, self-extinguishing insulation for G-E metal-clad switchgear gets appraisal before use.

APPLICATION OF ADVANCED IDEAS is assured by district electric utility application engineers. At forums held by General Electric, these engineers study the latest answers to field problems.



GENERATION—Design

Skimmer and Ladders to Take Fish over Dam

Proposed 120,000-kw Mayfield Dam's facilities for fish expected to cost Tacoma City Light $7-million, largest amount ever earmarked so by utility

Fish ladder and tramway for upstream travel and a skimming device for downstream travel are among fish-handling facilities to be installed by Tacoma City Light at its proposed 120,000-kw Mayfield Dam on the Cowlitz River in western Washington.

City Light engineers, working with the Washington Fisheries and Game departments and the U. S. Fish and Wildlife Service, developed the facilities for the $37.1 million dam. The utility is prepared to spend $7 million for the devices, reportedly the largest amount ever set aside by a utility to provide safe passage for fish around a dam.

Six Entrances to Ladders

Upstream facilities for salmon and steelhead will work in this fashion. Flowing water in six entrances will guide fish to the ladders. A barrier dam will prevent fish from swimming upstream past the ladders to the spillway.

Hatcheries Planned

After passing up the ladders, fish will move into the first of two containing pools equipped to prevent them from returning.

The second containing pool will have a movable screen at the bottom. This screen will ease fish into a hopper which will travel up the tramway at intervals to deposit them in a channel leading into Mayfield reservoir.

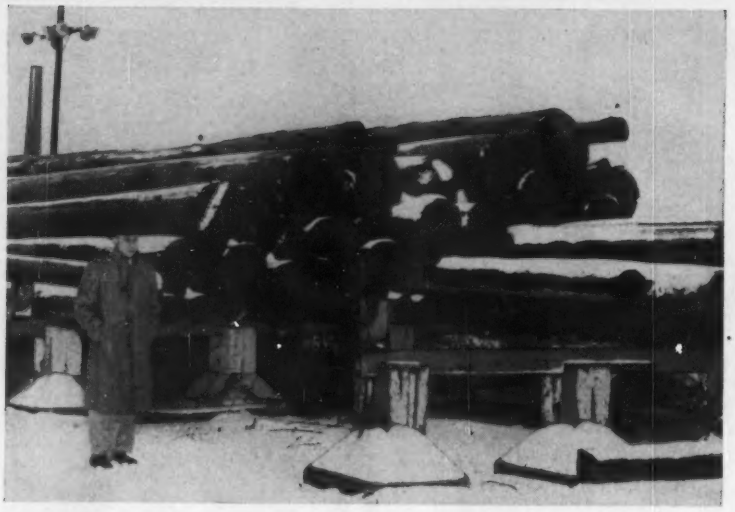
Fingerlings coming downstream into the reservoir will be attracted by flowing water into the skimmer device near the top of the dam. As the fish pass over a screen, much of the water will fall through the screen and be pumped back into the reservoir. The remaining flow, containing the fish, will proceed to pools leading to a fish easeway which will carry them downstream past the dam and power house to the river.

$365,400 Earmarked

City Light reports $365,400 has been allotted for research by the fisheries agencies.

Besides the fish-handling facilities, the utility plans to build hatcheries to compensate for possible fish losses. At the suggestion of the state Fisheries department, City Light plans to place the intake near the bottom of the reservoir where it will greatly reduce the possibility of fish being drawn into the turbines.

(*More How To on page* 110)



PORTABLE POLE SKIDS have low cost, give flexibility of layout, have pre-cast concrete supports frost doesn't damage. Drawing below details the supports

DISTRIBUTION—Construction

Portable Pole Skids Give Economic Flexibility

L. C. ALEXANDER, Superintendent, Transportation and Supplies Department, Cleveland Electric Illuminating Co, Cleveland, Ohio

The Cleveland Electric Illuminating Co has its own adaptation of portable pole skids for use in its pole yards. These skids are portable because the supports are of pre-cast concrete with widely flared bases which rest on the ground.

In making the concrete supports, a groove is fashioned for the I-beam skid, and a 2-in. steel pipe is cast into the concrete to provide a place for a hoisting sling. The portable skids have these advantages:

1. Low initial cost: Digging and the use of individual forms for each support are eliminated.

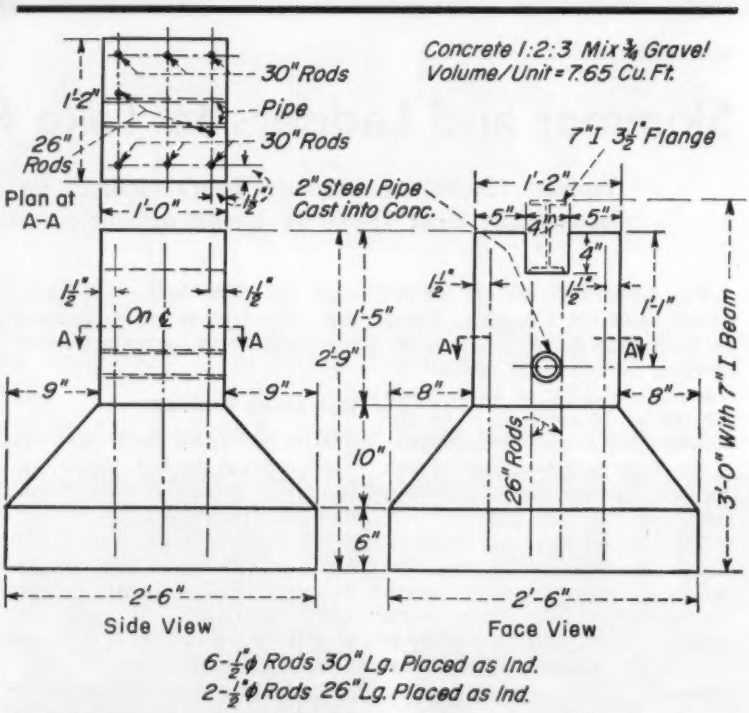
2. Flexibility of layout: The skids and supports can be picked up with a crane and placed where required.

3. Ease of replacement: Supports can be replaced by simply jacking up the skid and placing new supports in position after removal of the old ones.

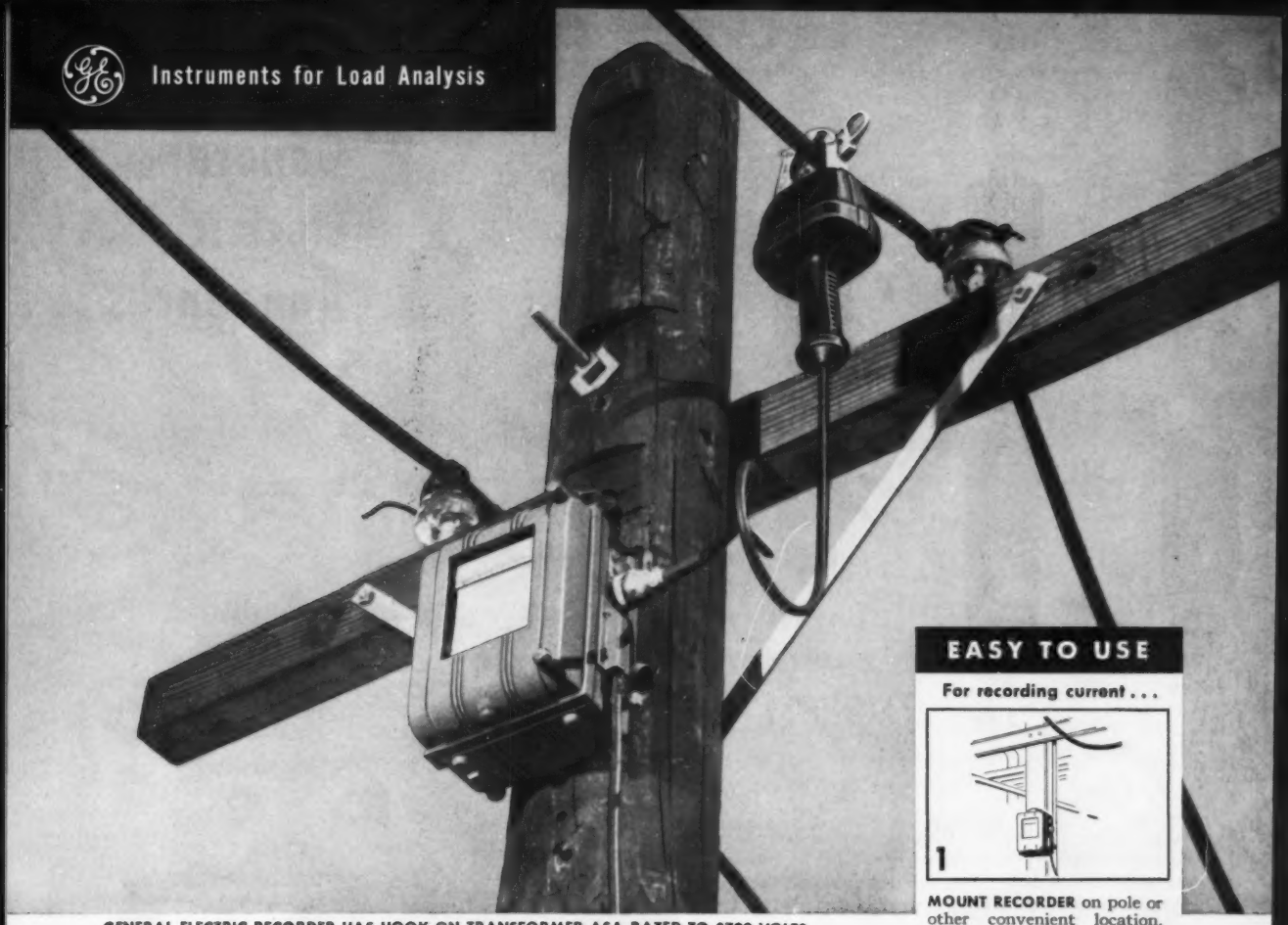
4. Supports last longer: Frost damage to supports buried in the ground is eliminated.

T. L. Goldsmith, general foreman of the Transportation and Supplies Department, noted several installations of this general type some years ago when visiting other utilities. What he saw was adapted for CEI's use during the subsequent rearrangement of the company's own pole yards.

(*More How To on page* 114)



Instruments for Load Analysis



GENERAL ELECTRIC RECORDER HAS HOOK-ON TRANSFORMER ASA RATED TO 8700 VOLTS

Here's an Easy Way to Help Solve Coming Electrical Load Problems

G-E inkless recorder allows fast hook-on installation; can operate continuously for 30 days without attendance

FOR LOAD ANALYSIS, the General Electric CF-7 hook-on recorder provides an easy way to obtain accurate records of electrical loads. This versatile instrument can measure and record either current or voltage without interrupting service. Fast, convenient, hook-on installation and the ability to operate continuously for 30 days without attendance make the recorder ideal for checking growing commercial and industrial loads.

INSTALLATION of the lightweight, portable instrument for recording either current or voltage requires only four simple steps. (See explanation at right.) Once the recorder is installed, little servicing is necessary other than replacing record rolls. Inkless recording means that there are no messy inkwells to clean. Weatherproof for dependable outdoor use, the recorder can operate accurately in a wide range of ambient temperatures. You can use the CF-7 recorder in any one of seven ranges: 15/75/150/750 amperes, a-c; and 150/300/750 volts, a-c. The butyl-molded hook-on transformer is ASA rated up to 8700 volts and the transformer secondary is short-circuit protected for operating safety.

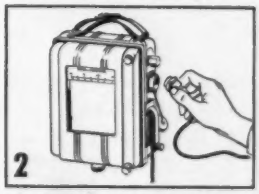
SEE FOR YOURSELF how the General Electric CF-7 hook-on recorder can help solve coming electrical load problems. Write Section 582–14, General Electric Co., Schenectady 5, New York, and ask for bulletins GEA-6104 and GEC-215, or contact your nearest G-E Apparatus Sales Office.

GENERAL ELECTRIC

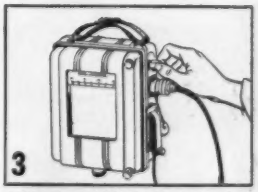
EASY TO USE

For recording current . . .

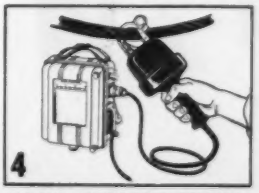
MOUNT RECORDER on pole or other convenient location. Connect recorder to either 120-volt or 240-volt power supply (50 or 60 cycles).



CONNECT TRANSFORMER LEAD to special socket on the side of the recorder.

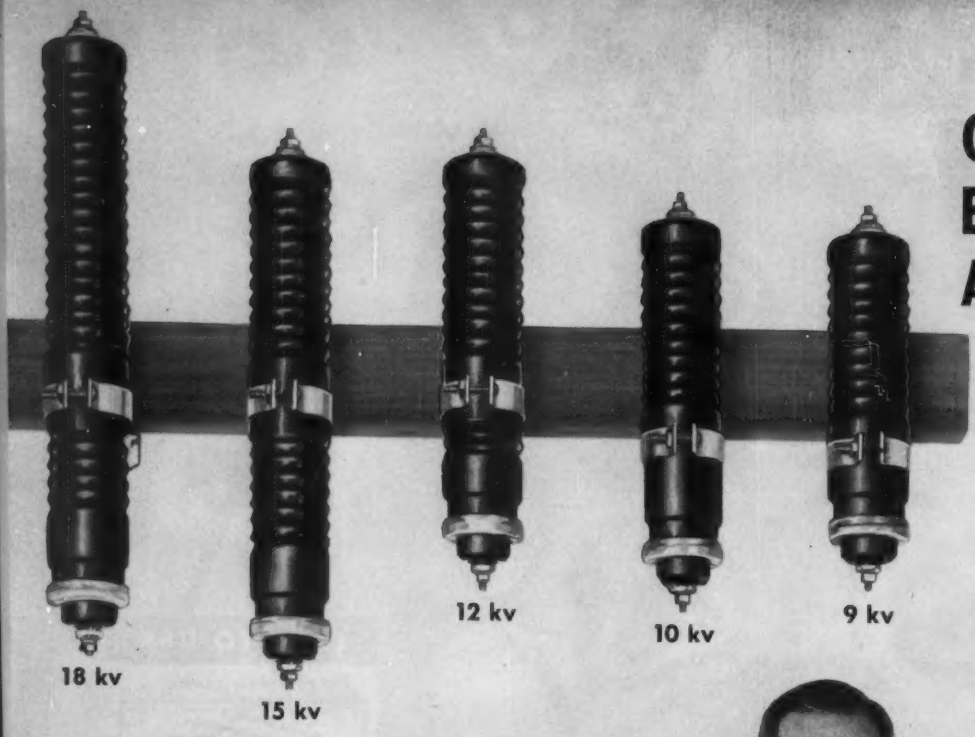


SELECT PROPER RANGE by setting selector switch for 15, 75, 150, or 750 amperes.

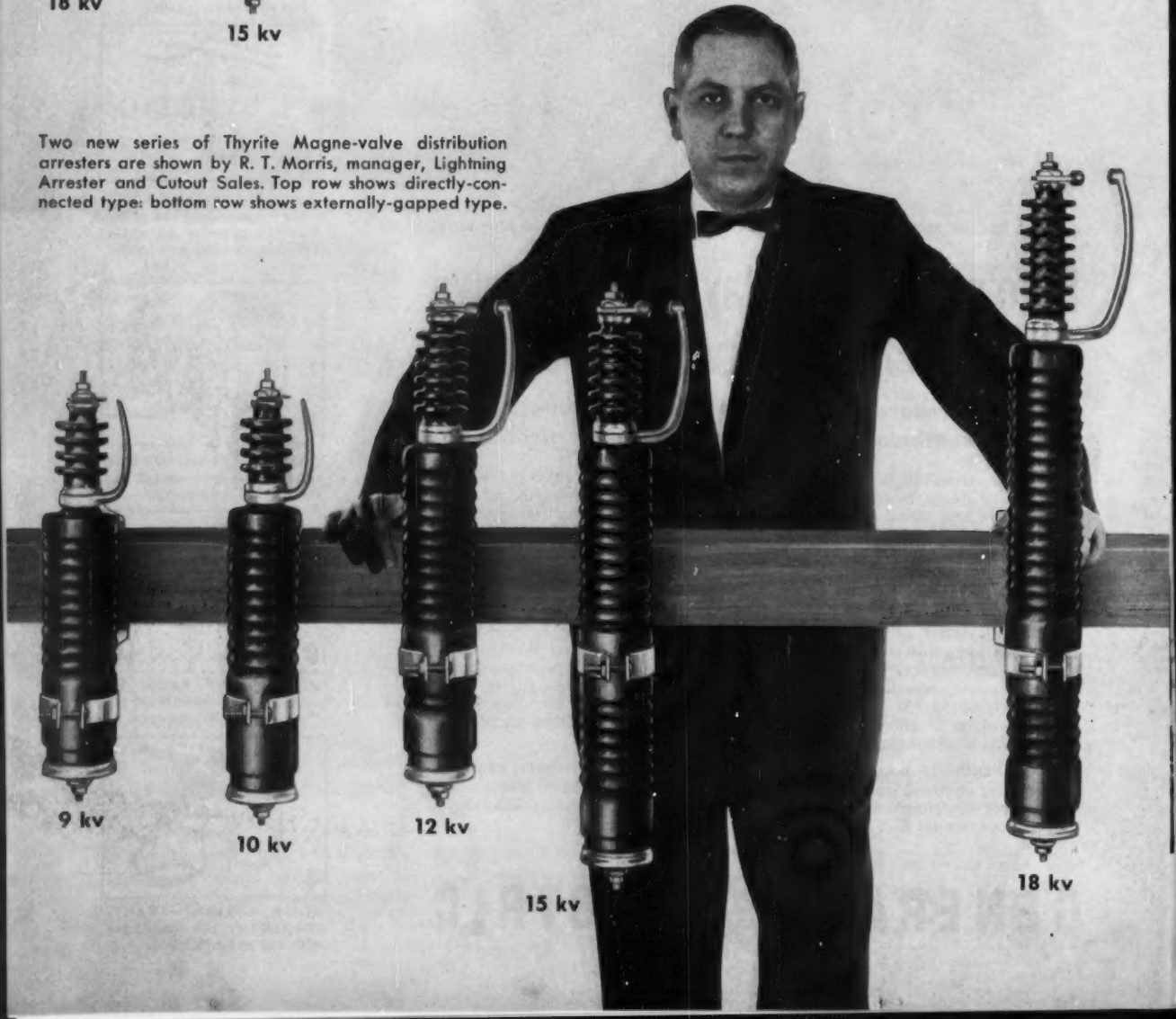


HOOK CURRENT TRANSFORMER on the conductor which is to be checked.

General Electric Announces . . .



Two new series of Thyrite Magne-valve distribution arresters are shown by R. T. Morris, manager, Lightning Arrester and Cutout Sales. Top row shows directly-connected type: bottom row shows externally-gapped type.



.....A COMPLETE NEW LINE OF MAGNE-VALVE DISTRIBUTION ARRESTERS

Smallest, lightest, valve-type arresters, with a proven operating principle that assures maximum system protection

Intensive General Electric research into improved lightning protection for distribution circuits has now resulted in a new and advanced line of valve-type arresters—the only type that can be applied anywhere on a system regardless of available short-circuit current.

For the first time in distribution arresters, you get the advantages of the exclusive Magne-valve principle so successfully used in G-E station-type and line-type arresters—a combination of *magnetic* action of series gaps to augment the *valve* action of time-proven Thyrite* disks, giving the highest degree of protection ever offered for distribution circuits.

Smaller size and weight of these new arresters—only a fraction of that of comparable arresters—is a further advantage of the new design. They are intended for separate mounting to crossarm or direct-to-pole.

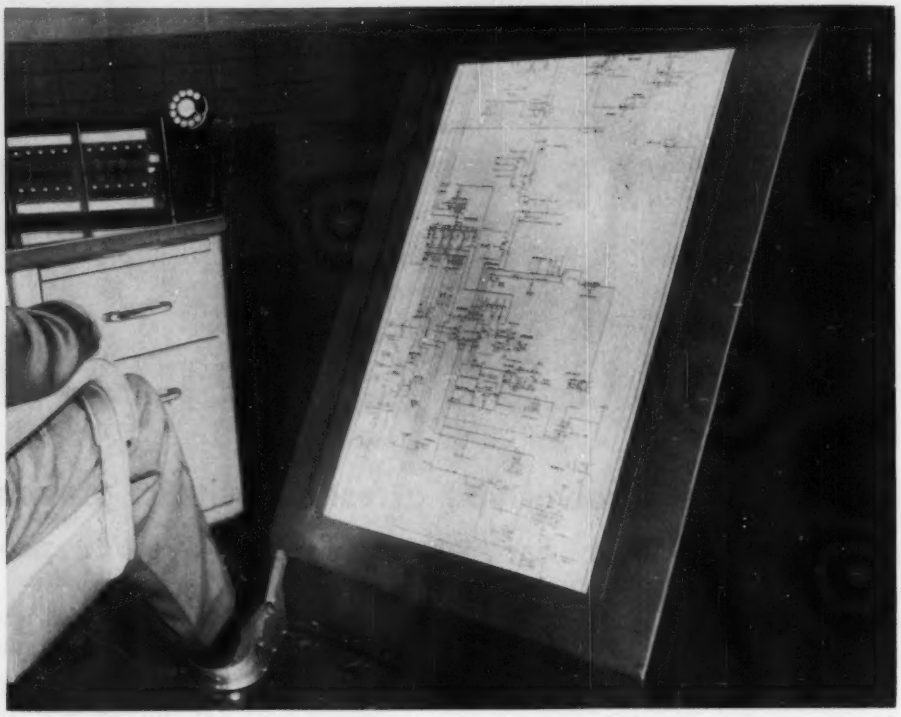
Ratings from 9 kv thru 18 kv are available in a choice of either the external-gap type—or direct-connected type with ground-lead disconnector. Both types give the best in overvoltage protection and both types provide positive protection against line-lockouts. Pellet-type arresters will still be available in voltage ratings 3 kv–15 kv to all users.

For full details of the new line of distribution arresters, check your nearest G-E Apparatus Sales Representative or write to General Electric Company, Schenectady 5, New York. Ask for bulletin GEA-6379. 432-17

*Reg. Trade-mark of General Electric Co.

Progress Is Our Most Important Product

GENERAL ELECTRIC



System Diagram Mechanized for Dispatchers

W. BYRON LAKER, Design Supervisor, Utah Power & Light Co, Salt Lake City, Utah

Reliability, ease of reading, and accessability for system change notations are main advantages of a mechanized system-diagram viewer developed by Utah Power & Light Co. Dubbed "The Thing," the device places any portion of the system diagram before the dispatcher almost instantly. It is moble, compact, and finished to blend with other equipment and furnishings in the new dispatching room. The open front permits system additions and changes on the map.

Until recently, company directors ordered switching from a 48x24-in. one-line diagram. As the system expanded, this diagram became increasingly complex and difficult to read. A definite need arose for a more efficient and convenient means to help direct system switching.

Territory Long, Narrow

Design of the new mechanized map was aided by the configuration of Utah P&L's system. Territory served and under the direction of the dispatcher in Salt Lake City is about 450 miles long and relatively narrow. A system diagram could be drawn on a long, narrow map with reasonable conformity to actual physical locations.

The mechanized system diagram viewer looks like a futuristic television set. It consists of a glass view plate set in the sloping side of a steel enclosure. The diagram map, a 28-in. wide cloth 18 ft long, travels up and down over the glass plate. Behind the plate are four fluorescent lamps, upper and lower main drums, a take-up drum to maintain tension on the cloth, a variable speed motor, chain drives, and a relay panel. A limit switch limits drum travel each way to keep the map from coming off the drums.

At one corner of the steel housing is a foot pedal controller.

Rapid and accurate control of diagram movement is obtained through a standard electronic adjustable-speed drive arranged for foot control instead of standard hand control. Foot control frees the dispatcher's hands for other uses. The drive provides stepless speed control of a dc shunt motor from an ac source.

Two Viewers in Use

Diagram position and speed of movement are adjusted through depression of the foot pedal, speed being proportional to the amount of depression. The 18-ft diagram can be completely rolled in either direction in 6 sec. The foot pedal shifts laterally to change motor rotation. In the left position, the map lowers; in the right, it rises. Undervoltage and overload tripping and dynamic breaking are provided through the electronic drive.

Emergency power for the mechanized viewer is taken from an engine-generator set in the dispatching room installed as power source for communications equipment and lighting. Thus emergency power for the viewer has

(*Continued on page* 120)

ANOTHER GENERAL ELECTRIC DEVELOPMENT IN PROTECTIVE RELAYS . . .

Transistors Open New Horizons in Protective Relaying

- ***Transistor-controlled negative-phase-sequence alarm relay is 3½ times more sensitive than previous designs.***
- ***Application of transistors to relays promises improved performance, smaller size and reduced maintenance.***

Transistor amplification, which has found so many important electronic applications, has now been applied to protective-relay design by General Electric. Transistors will lead to the future development and production of smaller relays having no moving parts, higher sensitivity and improved performance.

Transistors in circuit reduce power controlled by alarm unit contacts to less than 10 milliwatts, while a printed circuit helps eliminate wiring errors.

The first application of transistors to protective relaying for heavy electric power apparatus has been made in the alarm unit of the negative-phase-sequence overcurrent relay. Excessive negative-phase-sequence current, usually caused by unbalanced loads or untransposed transmission lines, may result in serious generator damage. For proper protection it is necessary to detect even small unbalances. Previous models of the alarm unit relay were able to pick up only when negative-phase-sequence current exceeded 25% of rated current. Because of greatly increased sensitivity, the new transistor-controlled unit can be set to pick up at any value from 7 to 15%.

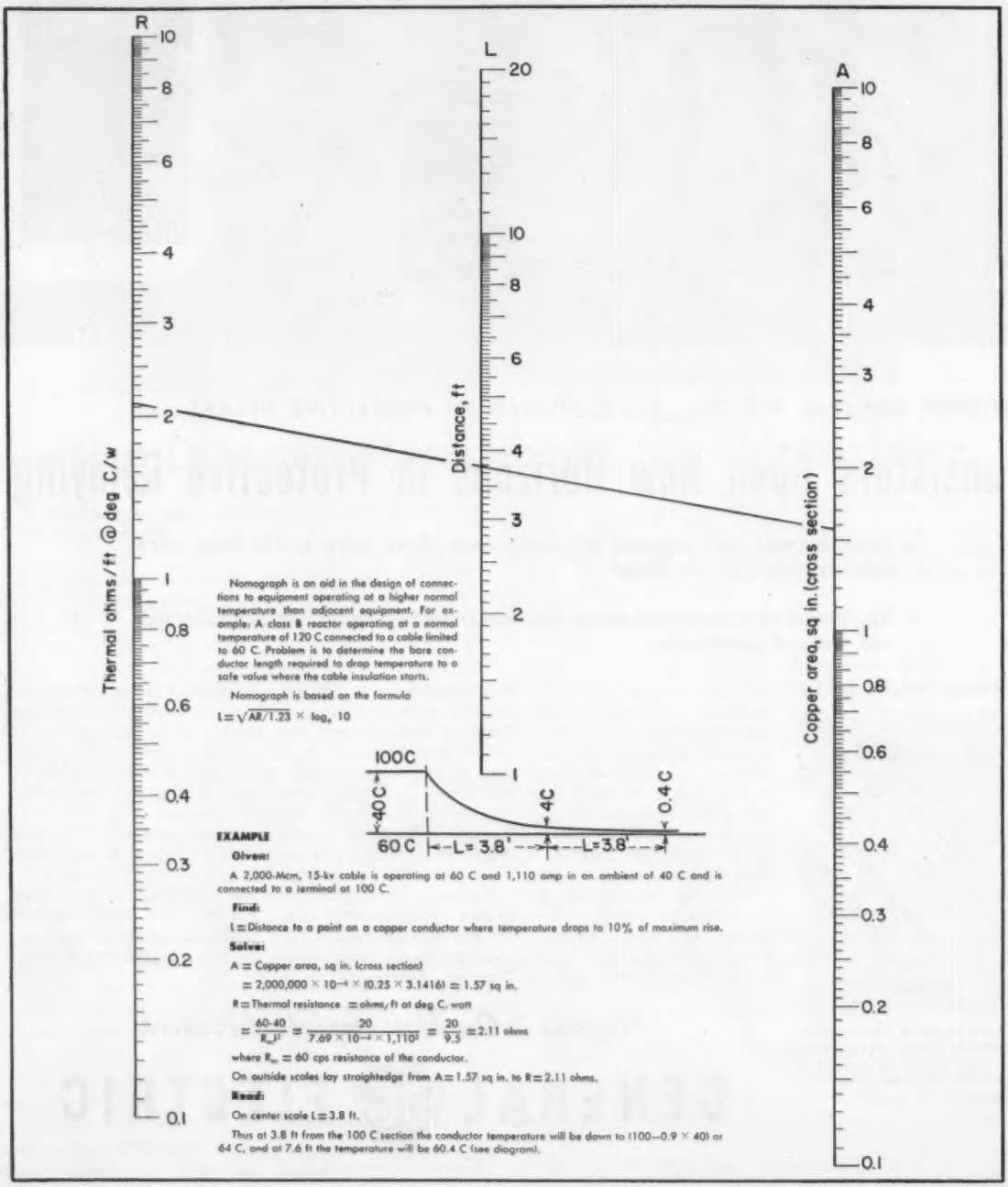
For more information about the application of transistors in this highly-sensitive relay, ask your G-E Representative for Bulletin GER-1190, "A Transistor-controlled Negative-phase-sequence Alarm Relay," or write to General Electric Company, Schenectady 5, N. Y. 522-4

Progress Is Our Most Important Product

GENERAL ELECTRIC

To Find Distance Along Copper Conductor to Drop Temperature to 10% of Maximum Rise

W. KEGELMAN, Engineering Development Section,
Philadelphia Electric Co, Philadelphia, Pa.



Nomograph is an aid in the design of connections to equipment operating at a higher normal temperature than adjacent equipment. For example: A class B reactor operating at a normal temperature of 120 C connected to a cable limited to 60 C. Problem is to determine the bare conductor length required to drop temperature to a safe value where the cable insulation starts.

Nomograph is based on the formula

$L = \sqrt{AR/1.23} \times \log_e 10$

EXAMPLE

Given:

A 2,000-Mcm, 15-kv cable is operating at 60 C and 1,110 amp in an ambient of 40 C and is connected to a terminal at 100 C.

Find:

L = Distance to a point on a copper conductor where temperature drops to 10% of maximum rise.

Solve:

A = Copper area, sq in. (cross section)

$= 2{,}000{,}000 \times 10^{-6} \times (0.25 \times 3.1416) = 1.57$ sq in.

R = Thermal resistance = ohms/ft at deg C, watt

$= \frac{60-40}{R_{ac}\,I^2} = \frac{20}{7.69 \times 10^{-6} \times 1{,}110^2} = \frac{20}{9.5} = 2.11$ ohms

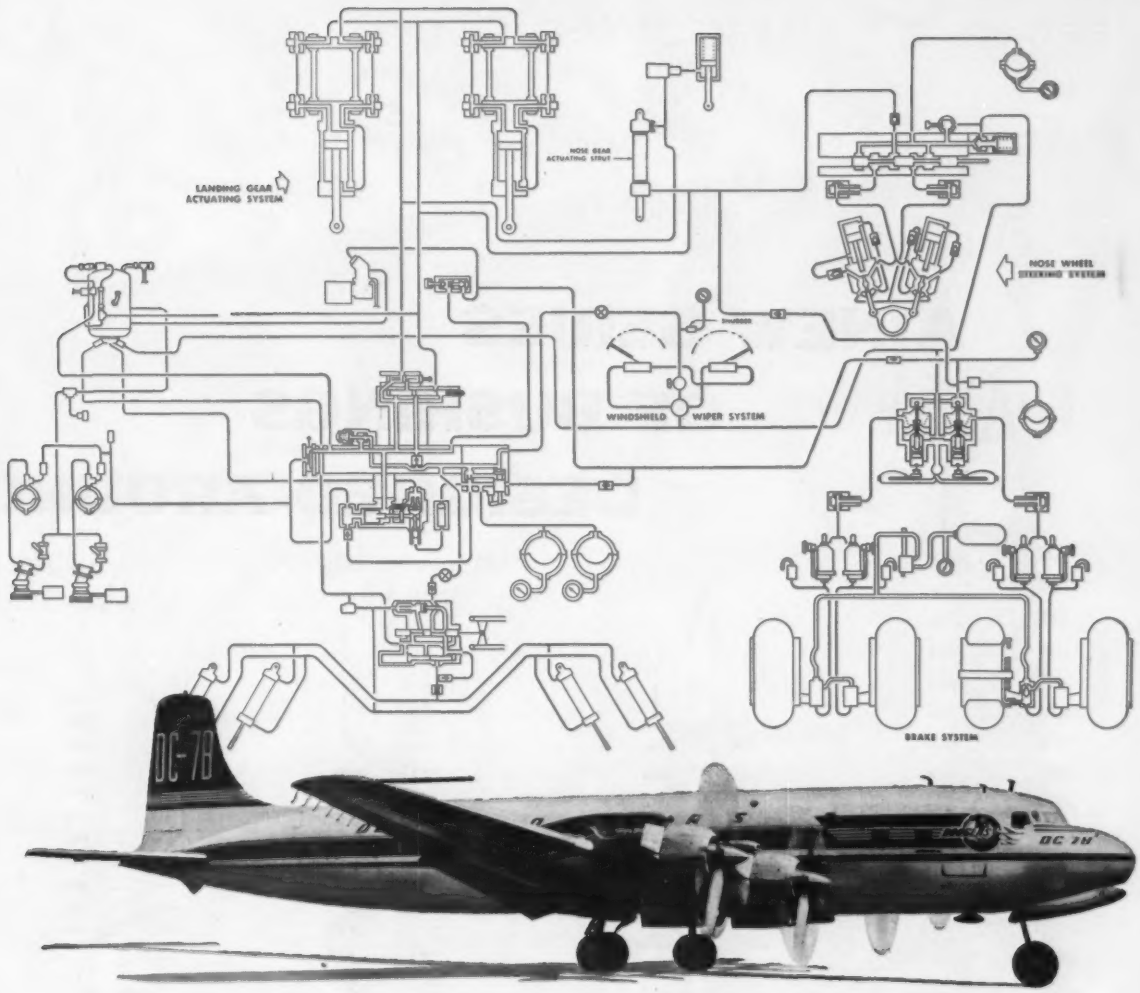
where R_{ac} = 60 cps resistance of the conductor.

On outside scales lay straightedge from A = 1.57 sq in. to R = 2.11 ohms.

Read:

On center scale L = 3.8 ft.

Thus at 3.8 ft from the 100 C section the conductor temperature will be down to (100—0.9 × 40) or 64 C, and at 7.6 ft the temperature will be 60.4 C (see diagram).



Enjay Butyl rubber— vital artery in newest airliners

Douglas chooses Enjay Butyl for rubber components of the hydraulic systems in many of its famous DC-7 airliners. These components, which help assure the dependable operation of everything from wing flaps to landing gear, are proving over millions of air miles their durability and resistance to wear.

Versatile Enjay Butyl rubber may well have a place in *your* operation. It will pay you to investigate the many technical advantages it has over other types of rubber. Its price and ready availability are advantages, too. For full information, and for technical assistance in the uses of Enjay Butyl, contact the Enjay Company today.

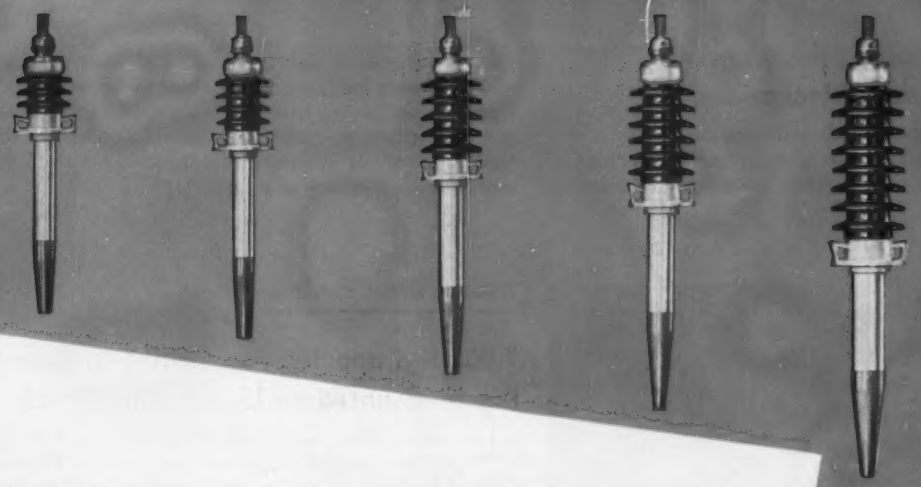
ENJAY BUTYL

ENJAY *Pioneer in Petrochemicals*

ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N. Y.
Other offices: Akron • Boston • Chicago • Los Angeles • Tulsa

Enjay Butyl is the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

A NEW SERIES OF BUSHINGS DESIGNED AROUND



TODAY'S THINKING

Meeting Industry Requirements For Every Application and Voltage

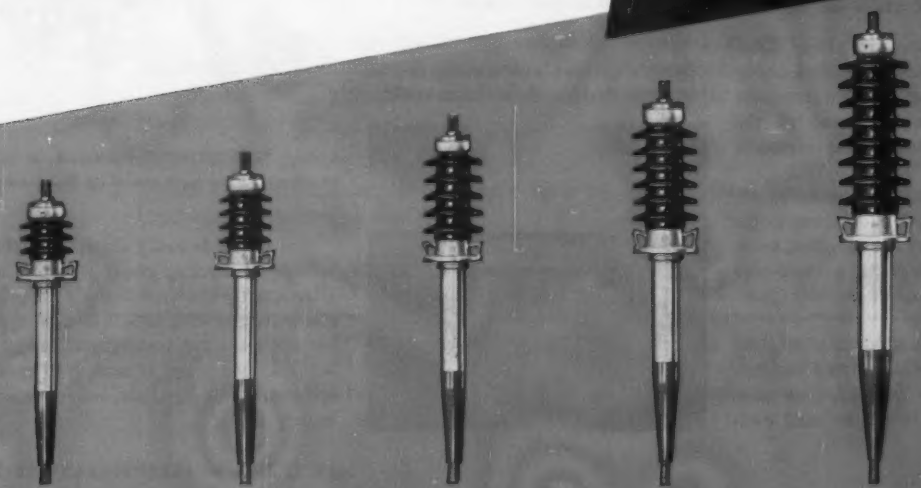
- For all voltages to 230 kv.
- Both transformer and circuit breaker types.
- Meet or exceed ASA Standards at all voltages so far adopted.
- Full multiple plate condenser construction of insulating core throughout entire range.
- Spring compression assembly and new gasketing techniques assure permanent sealing, and longest trouble-free life.
- Because of small diameter, these bushings are well-adapted to field replacement on older equipment by simple methods devised in accordance with your own requirements. This offers greater simplicity and reduction of replacement inventories.
- Built on nearly 50 years' success in the high voltage bushing field.

OHIO BRASS COMPANY, MANSFIELD, OHIO

4660-H

Ohio Brass

MANSFIELD OHIO, U. S. A.



(*Continued from page* 114)

System Diagram Mechanized

been made available at little additional expense.

Two viewers are in use in the dispatcher's office. To date, no mechanical difficulties have been encountered. Dispatchers quickly and easily adjust themselves to use of the viewers and have found them to be satisfactory. Operating techniques have been improved through their use. Dispatchers have easily carried out switching at different ends of the system, with only one portion of the system diagram in view at a time.

SURPLUS WINCH on 1½-ton flatbed truck is driven through a fluid drive by a gasoline engine. The rig has pulled 6,310 ft of 336-MCM ACSR conductor in a single haul

TRANSMISSION—Construction

7,000-lb-Capacity, Fluid-Drive Stringing Rig Is Mounted on Line-Pulling Truck

Line-pulling truck with fluid drive and 7,000-lb capacity has been added to the fleet operated by Portland General Electric Co. During the building of a 57-kv line, the unit pulled in 6,310 ft of 336-MCM ACSR conductor in one haul.

The rig consists of a surplus Navy winch mounted on a 1½-ton flatbed truck. Shafting from the pulling engine to the winch was replaced with a fluid-drive transmission. With six forward speeds and two reverse, the two-headed winch is capable of pulling line at a 1-mph rate. Brake and clutch mechanisms were added to allow the operator to control the winch through automobile-type pedals. In PGE tests, the truck pulled a 7,000-lb load without difficulty.

The operator sits facing the rear in a tractor-type seat which is adjustable up and down, forward and backward. A hollow base under the winch can be filled with 400 lb of water to stabilize the truck while pulling a heavy load. biggest single cost was $750 for the surplus winch.

TRANSMISSION—Construction

Clamps Loaded Crossarm While Bolt Is Removed

M. D. PROWSE, Line Foreman, Appalachian Electric Power Co, Charleston, W. Va.

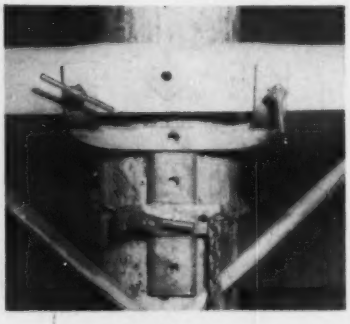
The special crossarm clamp illustrated here is a convenient, timesaving means for keeping a loaded crossarm in position during removal of the through bolt attaching the crossarm to the pole.

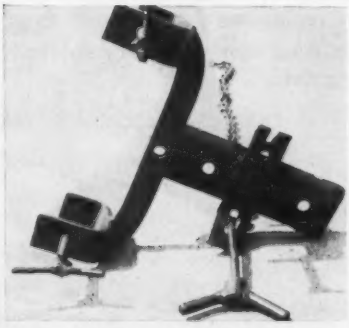
Often the through pin must be removed during conversion from single to double crossarm construction, or in changing a two-wire to a three-wire circuit by addition of another pole-top pin.

In such alterations, use of the clamp dispenses with untying conductors and transferring them to temporary supports. It can be used even at angles in the line and at points of heavy downstress. Furthermore, it may be used in replacing a crossarm with a new one on the opposite side of the pole.

It keeps a loaded crossarm in position during any line work requiring removal of the through pin.

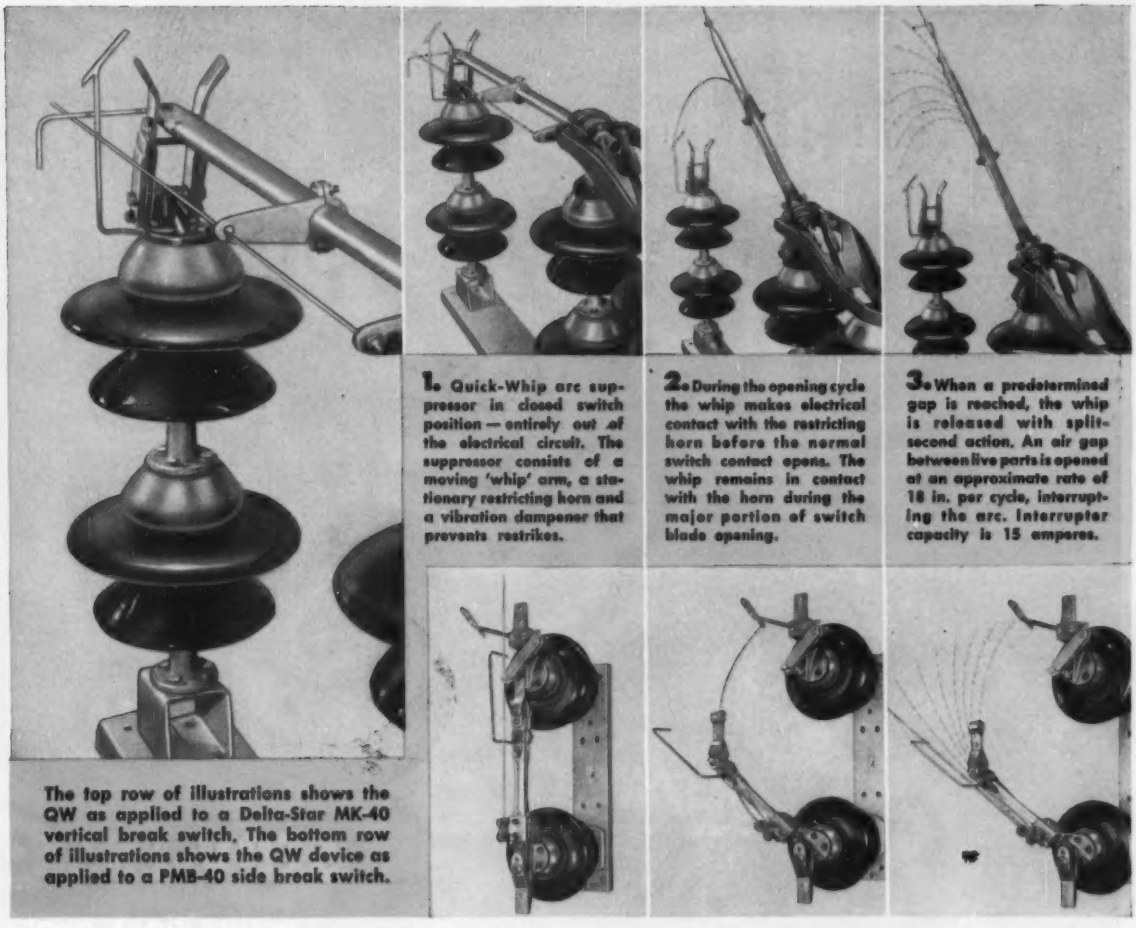
CLAMP dispenses with untying conductors, transferring them temporarily





SCRAP TRANSFORMER HANGAR, a ¼-in. chain, wing nuts make up the clamp

The device is easily clamped to the pole by a binding chain and to the crossarm by the two ⅝-in. rounded-end bolts and wing heads. The clamp's parts are a scrap transformer hanger, a ¼-in. chain, and several wing nuts. Its cost, including labor, was approximately $15.



1. Quick-Whip arc suppressor in closed switch position — entirely out of the electrical circuit. The suppressor consists of a moving 'whip' arm, a stationary restricting horn and a vibration dampener that prevents restrikes.

2. During the opening cycle the whip makes electrical contact with the restricting horn before the normal switch contact opens. The whip remains in contact with the horn during the major portion of switch blade opening.

3. When a predetermined gap is reached, the whip is released with split-second action. An air gap between live parts is opened at an approximate rate of 18 in. per cycle, interrupting the arc. Interrupter capacity is 15 amperes.

The top row of illustrations shows the QW as applied to a Delta-Star MK-40 vertical break switch. The bottom row of illustrations shows the QW device as applied to a PMB-40 side break switch.

New Quick-Whip device effectively snaps the arc!

This new Delta-Star Quick-Whip arc suppressor effectively and efficiently reduces arc hazards and phase-to-phase faults. It is designed for use on switches rated from 7.2 kv through 69 kv.

A Quick-Whip arc suppressor can be easily installed on vertical break or single or double side-break switches. Its simplicity makes its cost nominal. Its rust-resisting, durable stainless steel construction makes it a lasting investment.

Quick-Whip arc suppressors may be furnished as original equipment on Delta-Star vertical break or single side break switches. Your Delta-Star representative has all the facts.

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.

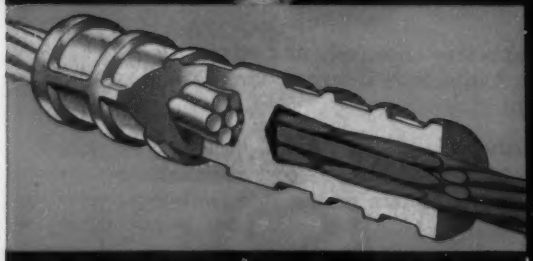
2437 Fulton Street · Chicago 12, Illinois · District Offices in Principal Cities

Quality-Control

SERV-ENS

assure tight, neat service entrance connections

These sleeves make it easy for your crews to make perfect connections every time . . . without wasting time. Serv-Ens are perfect for splicing all combinations of ACSR, aluminum and copper conductors for service entrances. To save time, each sleeve is plainly marked with conductor cut-off length and size range. The bores contain KEARNALENE, a corrosion inhibitor. Ends are sealed with plastic caps . . . color-coded for quick size identification.



Between the two bores of each Serv-Ens sleeve is a solid metal barrier. Each conductor fits into its own socket. The metal "spacer" prevents galvanic action between dissimilar conductors . . . eliminates strand wicking of water between them.

JAMES R. KEARNEY CORPORATION

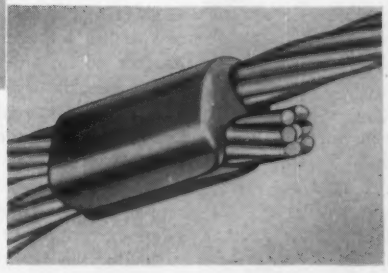
4224-42 CLAYTON AVE., ST. LOUIS 10, MO.

Canadian Plant: GUELPH, ONTARIO

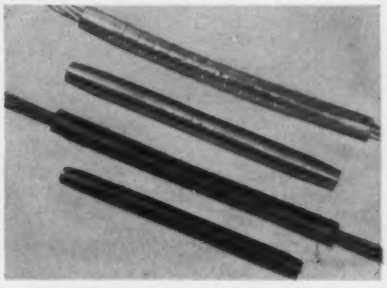
Your Construction with KEARNEY COMPRESSION CONNECTORS

TERMINAL CONNECTION ADAPTER

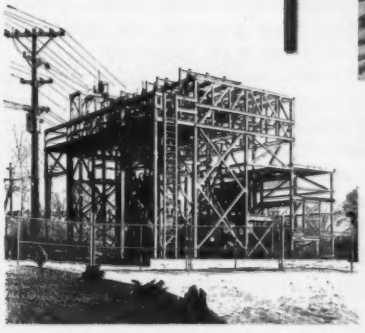
This special-purpose Serv-En eliminates problems in connecting aluminum conductors to the bronze or copper terminals of transformers, cutouts, capacitors, etc. The aluminum sleeve is *factory bonded* to a length of soft-drawn copper wire and the joint is sealed with highly weather-resistant plastic.



SQUEEZON . . . *the original compression connector* . . . for dozens of time-saving, trouble-saving applications . . . features KEARNEY's exclusive "built-in spacer" design that grips each conductor around its full circumference . . . conductors never touch, prevents strand-cutting and galvanic action.



SPLICING SLEEVES . . . for fast line splices that are electrically and mechanically superior to any other method.



Sleeves Field Tested . . .

Here at KEARNEY's 445,000 KVA Substation Laboratory all equipment is tested under rigorous field conditions. KEARNEY Certified Ratings are actual, proved performance ratings . . . not just theoretical calculations. You can be sure they will do the job they are supposed to do . . . with a generous margin of safety!

310

for BETTER CONSTRUCTION
SAFER MAINTENANCE

Specify JAMES B. KEARNEY & COMPANY

KEARNEY PRODUCTS

The Mark of Quality

With a Double-Barreled Approach . . .

SMUD Increases Its Appliance Load

- **Gets more water heater commitments in two months than it his served in eight years**
- **Does it by getting to home builder early in game, giving free promotional help**

A double-barreled appliance load building scheme is piling up sizable chunks of kilowatt output for Sacramento (Calif.) Municipal Utility District. The barrels are:

- Sell home builders on the all-electric theme before their plans leave the drawing boards.
- Provide free ad space and help of district representatives to sell the builders' homes.

And here's how they're scoring: In the first two months of SMUD's water heater promotion, 5,873 units were committed for installation in new homes, or more than the total number of units in service during SMUD's entire eight years of operation. And, in a recent Parade of Homes, 20 houses out of 26 had adequate wiring and 19 had all-electric kitchens and laundries.

Gets to 'Em First

Early contact with the home builder provides the main spark for the load building program. By working with planning commissions, the FHA and VA, land engineers, architects, financial institutions, and home builder organizations, SMUD learns of home building plans at the earliest opportunity.

Through these contacts, attendance at trade association meetings, and at two annual banquets, SMUD sells the all-electric theme and extends its services to builders.

The speculative builder with projects of 50 or more homes has often been a traditionally tough critter to take a bead on. He has generally ignored the installation of electric appliances in an effort to maintain low building costs. With the speculator, SMUD points out the greater value attached to new homes wired for, or equipped with, electric appliances. Then the district clinches the deal by offering free newspaper advertising featuring the builder's development and providing employees to staff model homes.

Another MODEL HOME
with built-in
ELECTRIC KITCHEN
Flameless electric water heater and electric range are features of the
Skylark MODEL HOME
OPEN FOR INSPECTION 9 a.m. 'til dark
Furnished by Elder's Maple House. Located in Skycrest Terrace
SEE IT TODAY.
Look for the FLAMELESS ELECTRIC KITCHEN mark of the Modern Home
SACRAMENTO MUNICIPAL UTILITY DISTRICT
MODEL HOME
GREENBACK LANE
FAIR OAKS BLVD.

SAMPLE AD furnished free by SMUD. Amount of advertising builder gets is geared to home's degree of electrification

SMUD provides 40 in. of advertising in Sacramento's two dailies for adequate wiring. If ranges are installed, another 40 in. are added in both papers. Circuits for a dishwasher, garbage disposer, and dryer bring the builder 20% more advertising space. During the electric water heater campaign, the district offered 40 in. for installation of these appliances.

Besides personal promotion in model homes, SMUD representatives conduct training classes for subdivision salesmen on how to meet any buyer objections.

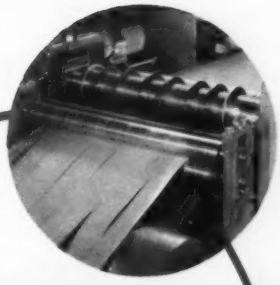
Staffing the district's home builders promotion are three men who work full time with speculative builders. Two more men promote adequate wiring with speculative and custom home builders. Another employee contacts banks and the builders' exchange. Out-of-town builders are contacted in person by a SMUD team. All of these activities are coordinated through regularly scheduled weekly meetings of SMUD personnel.

Year's Appliance Sales Start Off with Bang

The electric appliance sales picture, based on first-of-the-year samplings, appears promising for most lines. Items:

- Home freezer sales in Kansas Gas & Electric Co's territory earlier this year were up 18.7% over 1955.
- "Operation Big Switch" of Florida Power & Light Co aims for dealer appliance sales volume of $100 million in 1956, $16 million above last year's record-breaking total.
- Electric appliance sales are 18% higher in New York State Electric & Gas Corp areas with ranges, automatic washers, and dryers scoring one-fourth more sales.
- A dealer contest is sparking dryer sales and upgraded wiring for New Jersey Power & Light Co customers.
- Philco Corp has upped appliance production as high as 60% to catch up with heavy demand.
- American Home Laundry Manufacturers' Association said 564,923 home laundry units were sold in January, including 123,779 electric dryers. This is 17% above January 1955 unit sales, 8% higher than December.

MOLONEY ELECTRIC



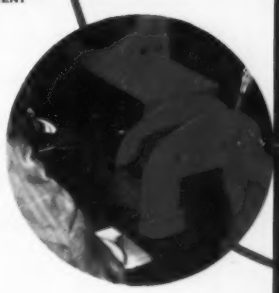
SLITTING CORE STEEL

MAKING GOOD TRANSFORMERS BETTER

Ever since the early days of commercial electricity, Moloney has been constantly on the move developing and producing better transformers. Transformers generally available during the "nineties," had high losses, poor regulation, relatively short thermal life and extreme susceptibility to damage from lightning. Moloney's modern HyperCore Distribution Transformers feature greatly improved losses, excellent regulation, high overload capacity and unmatched resistance to lightning surges.

Today's Moloney HyperCore Transformers have wound cores made from grain-oriented, cold-rolled, silicon steel, making possible transformers of smaller physical size, lighter weight and improved loss characteristics. Full advantage of these qualities cannot be realized on production runs of transformers without close control over processing. Care in annealing cores . . . checking the nitrogen atmosphere and controlling the heating and cooling cycle in both time and temperature . . . is of extreme importance. Likewise, care in impregnating, baking and cutting the cores is necessary to maintain top quality. Moloney's quality control engineers constantly check these processes.

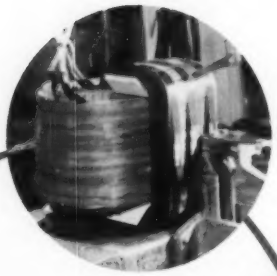
CORE WINDING DEPARTMENT



CORE TESTING

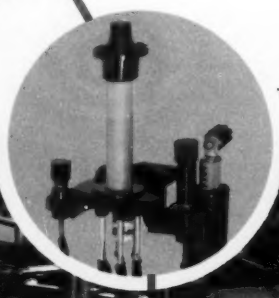
MOLONEY ELECTRIC COMPANY, ST. LOUIS 20, MISSOURI

Unlike windings on the "old timers," today's transformer windings are much more than a "bunch of turns" designed to give the proper transformation ratio. Instead they represent a scientific application of insulating materials and cooling ducts designed to provide high resistance to lightning surges, and safe operating temperatures during heavy short-time overloads. These modern windings are stronger mechanically and can better withstand the forces acting under short circuit conditions. Constant inspection and tests keep tab on these qualities . . . research keeps improving them.



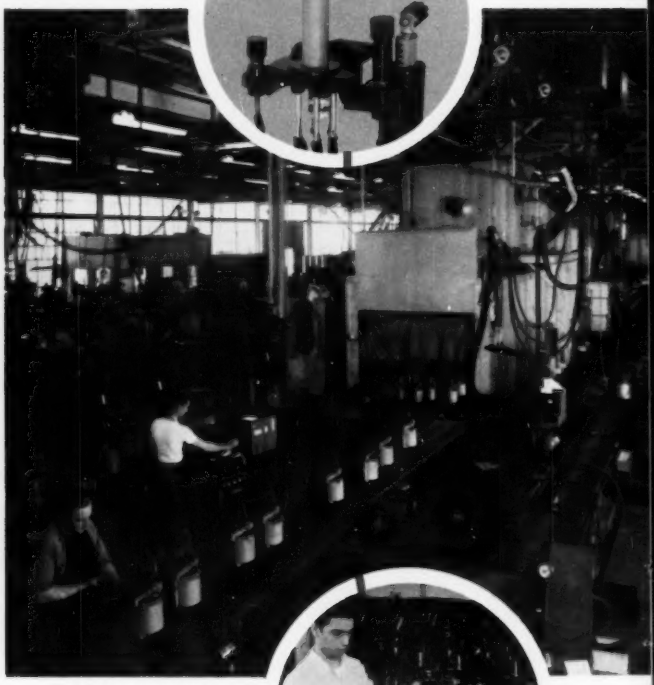
ASSEMBLING
CORE-AND-COIL UNITS

COIL TESTING



TAP CHANGER

COIL WINDING DEPARTMENT



CORE-AND-COIL ASSEMBLY BAY

WINDING COILS

TESTING
CORE-AND-COIL UNITS

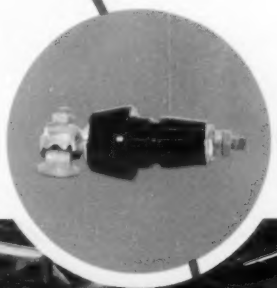
Moloney HyperCore Distribution Transformers get quite a going over before they are crated for shipment. They are tested at various stages of production, as well as at the end of the production line. Coils are tested in the winding department and cores are tested in their department. The core-and-coil assemblies are tested before they are installed in their tanks and again after the transformers are completely assembled. Tests include standard commercial production tests, impulse, audio sound level and radio influence tests.

MOLONEY ELECTRIC

MOLONEY ELECTRIC COMPANY

The ancient "tubs" frequently experienced an early demise because they were "freebreathers." Entrance of moisture and oil sludging due to oxidation took their toll. Not so with today's Moloney transformers with their completely sealed tank design. Moisture and oxygen are sealed out. Other features that research has given the modern HyperCore Transformer are . . . leak-free electronic welding of tanks . . . triple-thick base construction . . . the best in protective paints.

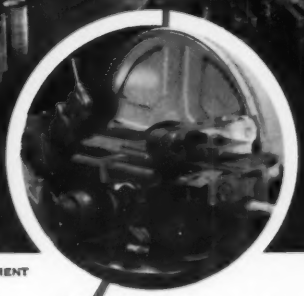
FINAL ASSEMBLY



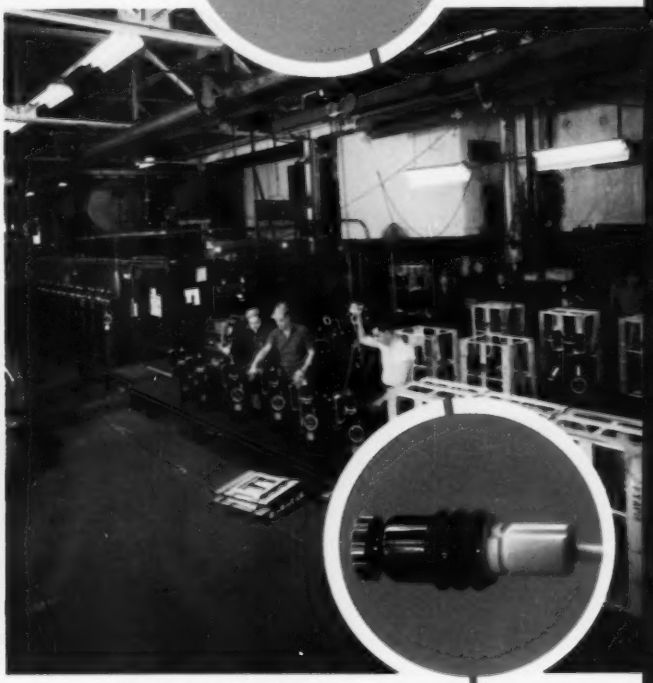
LOW VOLTAGE BUSHING

TANK PAINTING

TANK DEPARTMENT



ROLLING BASE FLANGE



TESTING AND CRATING DEPARTMENT

HIGH VOLTAGE BUSHING

SEAM WELDING TANK WALL

Moisture is removed from windings by vacuum and heat treatment. Air entrained in the transformer oil, and air bubbles that may become trapped in the windings, are removed by vacuum treatment of the entire transformer after assembly. This type of careful processing assures high surge strength.

Naturally today's HyperCore Transformers are provided with many mechanical features that weren't thought of during the early days. These include . . . keyed bushings that won't turn when the terminals are tightened . . . electro-tinplated terminals permitting use of either copper or aluminum conductors . . . high voltage bushings (8.6 Kv and below) with enclosed terminals and insulating knobs for safety and convenience . . . rotary, snap-action tap changers feature high contact pressures . . . and corprene gasket sealed tank covers.

CORPRENE GASKETED COVER

Sixty years devoted exclusively to the design and fabrication of transformers have led to a reputation of quality and performance second to none.

Additional important features and testing procedures are on their way to make certain that tomorrow's Moloney Transformers are even better through Moloney research and quality control.

Litho in U.S.A.

MOLONEY ELECTRIC COMPANY

Power Transformers • Distribution Transformers • Load Tap Changing Transformers • Regulating Transformers • Step Voltage Regulators • Primary Unit Substations • Secondary Unit Substation Transformers • Network Transformers • Series Street Lighting Transformers • Subway Transformers • Industrial Dry Type Transformers • Capacitors • Magnetic Components For Electronics

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

The Push Is On!

LBE consumer kickoff set for Sunday; utilities get ready for biggest promotion

Next Sunday evening the American public will get its first exposure to a new selling force which—if all goes as expected—should make some material changes in its buying and living habits in the years ahead.

The force: The industry's "Live Better . . . Electrically" program. Its target: An estimated 40 million televiewers who will watch Judy Garland on a special CBS network show beginning at 9 p.m. EST, April 7.

In the days following millions more will read full-color ad spreads in nine consumer magazines and the biggest load building venture the industry has ever seen will be underway.

At the moment utilities are readying their own tie-in plans. Since the Feb. 8 closed circuit telecast they've been working furiously to line up trade help. Now they'll train their promotional guns on the consumer.

Items:

• In Cleveland, the Electric Illuminating Co will plug LBE on monthly service bills, deliver lectures to some 14,000 home economic students, Boy and Girl Scouts in addition to its heavy newspaper, radio and TV schedule. It also plans tie-ins with 100 model electric homes, cooperative advertising with home builders and dealers, home show exhibits, and employee and salesmen training courses.

• In the Canton area, Ohio Power Co is placing 15-ft LBE banners in every one of its 40 offices, and gives smaller ones to cooperating dealers. It will use the LBE musical theme on all its radio and TV shows and plans one-day jaunts to Nela Park for builders and electrical contractors.

• In the west, Idaho Power Co hopes to boost its residential electric use to an average 10,000 kwhr by 1965. Neighboring Washington Water Power Co aims to hit the 10,000 kwhr mark by 1963. WWP reports one local chapter of National Electrical Contractors Association has engaged an architect to design an all-electric home.

• In Los Angeles, Residential Sales Manager Floyd Lovelace of the Department of Water & Power is elated with the builder cooperation he's getting. "The closed circuit telecast had a terrific impact," he says. "Builders have committed themselves verbally to 100-amp wiring and the major appliances in over 1,000 homes which will be built this year."

• Tacoma City Light, which cosponsored its closed circuit show with Puget Sound Power & Light Co, looks for its LBE efforts to help jump average domestic use by 4,000 kwhr in the next five years.

• Arizona Public Service Co and Salt River Power District express similar optimism after presenting their LBE programs to 300 businessmen at an open-air luncheon last month in Phoenix. Both utilities plan broad consumer and trade campaigns.

But bullish as they might seem, many utilities quickly admit the going will not be easy. They foresee tougher competition ahead not only from competitive fuels, but from other products and services that vie for the consumer's dollar. As one appliance manufacturer points out: "It's industry versus industry competition that we have to face today in millions of homes. (To beat it) we must tell our own basic industry story first. We must tell our customers that when they live electrically, they will live better."

Sunlamp Buying Habits Revealed by Survey

Why and where do people buy sun lamps? One maker, Sperti Faraday, Inc, queried some of its customers (144 answered out of 200 questioned) to find out. Here's what the survey developed:

• 51% of the lamps were purchased in department and appliance stores.
• 17% received the lamps as gifts.
• 54% of the purchasers were men.
• 91% were over 25 years old.
• 72% were married.
• 53% had homes with children.
• 66% purchased predominantly for health reasons.
• 34% purchased primarily for cosmetic purposes, with health as a secondary motive.

Electric Heat in 100,000 Homes a Year Is Forecast

Within five years more than 100,000 houses heated by electricity will be built annually, forecasts the National Mineral Wool Association. The prediction is made in its recently-published booklet, "How to Insulate Your Home for Electric Heating."

Insulation standards recommended in the booklet are 4 to 6 in. of mineral wool for ceilings and roofs, 3-in. batts or blankets for walls, 2 to 3 in. under floors, and 2 in. perimeter insulation when a concrete floor is in contact with the ground.

Single copies are available free of charge, quantities at 5¢ each. Write 2906 Americas Building, Rockefeller Center, New York 20, N.Y.

S & S SHORTS

Gears for LP Competition

Virginia Electric Power Co has prepared a bottle gas story based on market surveys, comparative costs and impartial tests of U. S. Dept of Agriculture's Beltsville, Md., study. Presented before VEPCO area dealers, the story suggests ways of meeting LP competition.

Grinders Big Farm Sellers

Farm Journal, Inc, says bench grinders and power drills are most popular farm workshop tools, being used in 80% of farms. Electric welders are found in 38%. One-third of the Journal's survey sampling had actual workshops with average investment of $676 each in equipment and hand and power tools.

New Booklets

• A "do it yourself" theme showing dealers how to increase electric range sales features a new Hotpoint Co booklet. It is divided into sections on plans, tools, and demonstration, the last telling 18 tested electric range sales clinchers.

• Three electric water heater promotional booklets aimed at 1) residential consumers, 2) plumbers, architects, and builders, and 3) farmers are offered by National Electrical Manufacturers Association, 155 East 44th St., New York 17, N. Y.

Home-Made Heater Dries Beer Storage Tanks

Costs only 41.5¢ per tank, yet does job 2 hr faster than steam formerly did. Now only two men are needed instead of four

R. J. O'CONNOR, Sales Promotion Specialist, Idaho Power Co, Boise, Idaho

Electric drying of brewery tanks is saving time, labor, refrigeration costs, and fuel for Bohemian Breweries, Boise, Idaho, with respect to the former method of steam drying. Annual cleaning time of the company's 44 wood beer storage tanks is cut by two hours per tank, with only two men instead of four, for a cost of 41.5¢ per tank. Use of electric heat does not place an additional load on the unit that refrigerates the space housing the tanks.

Every year, each tank is separately drained, dried, re-pitched and filled before work is started on another. Tanks of 108-bbl or 211-bbl capacity are about 7 ft in diameter and 12 ft long. They are kept in a large room held at 33F.

Formerly, steam from a boiler outside the storage room was supplied through a long 6-in. diameter hose shoved into a manhole in the tank. During the 5 hr required for drying, the large and bulky hose presented a nuisance and a hazard to foot traffic. Overall temperature of the storage room increased 7F as escaping steam deposited large amounts of water vapor on the cooling pipes.

Tanks now are dried electrically with a 9-kw heater made with elements from a clothes dryer connected for 220-v 3-phase operation. A 1/6-hp capacitor motor drives a squirrel-cage fan to deliver 300 cfm of air over the heater. Both heater and blower are placed inside the tank on the floor for about 3 hr.

When the tank is dry, the heater is disconnected with the fan left on to circulate air inside the tank during the re-pitching operation. Energy consumed per tank during the drying operation is 27.51 kwhr at a cost of 41.5¢.

9-KW ELEMENT from a clothes dryer combines with a 1/6-hp motor to dry 108-bbl and 211-bbl beer tanks in about 3 hr

Electric Furnace Does Good Job on Titanium

KARL A. STEFEK, JR., Power Consultant, Southern California Edison Co, Inglewood, Calif.

"Electrical energy maintains outstanding quality and production requirements in the process of heat treating and forming titanium and its alloys." This is the opinion of John M. Dieter, heat treating specialist and president, Aeromet, El Segundo, Calif. Aeromet heat treats and forms titanium principally for use in airplane parts.

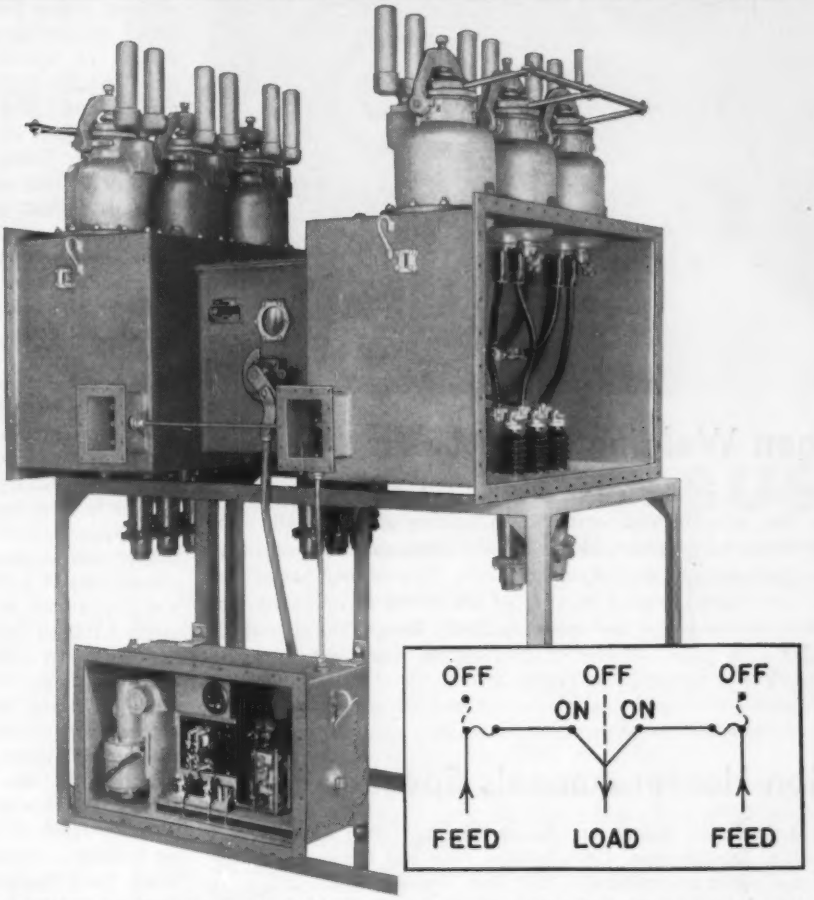
Prior to installation of any heat treating furnace, Aeromet investigated the installation costs of electric and fuel-fired furnaces suitable for the processes to be performed. They found that an electric furnace would save 6-10% in costs by eliminating expensive baffling and other construction necessary for indirect combustion firing. Portability and minimum space requirements also were important factors in favor of electric units.

Aeromet has two custom-built furnaces, each rated 40 kw, 480 v, 3 phase, under 24-hr operation for the processing of titanium. Each measures 3x3x7 ft with a total volume of 63 cu ft. A form of convection heat is produced in the furnace by banks of coil type, edge-wound resistors located in a recirculating air stream.

Furnace temperature regulation for the stress relieving of titanium is critical. Minimum temperatures must be kept above 900F to insure relieving residual stresses. Because heat treating scale of titanium becomes increasingly difficult to remove as temperature increases, a maximum temperature of 1,050F is allowable.

Electric furnace operation has kept well within these limits. Thermocouple readings disclose that furnaces are maintaining ±7.5F at an operating level of 1,000F. Operating costs of the two-furnace installation on a 24-hr basis are 35-39¢ per hr per furnace.

COMBINE "FC" OIL FUSE CUTOUTS WITH SELECTOR OIL SWITCHES



The "RADFC" subway fuse-switch unit shown connects the load to duplicate feeders, 12.5 Kv. 4-wire solidly grounded neutral. The automatic mechanism throws over the oil switch when the preferred feeder voltage fails—and throws back when preferred feeder voltage is restored.

The FC61 oil fuse cutouts, included for each feeder, serve as feeder isolators and fuses for overload and short circuit protection.

The automatic control circuits are connected ahead of the fuse cutouts to avoid oil switch transfer under short circuit conditions.

G&W combination fuse-switch units are helping provide flexibility and service continuity in many distribution systems—large and small. The cost is very reasonable. A minimum of maintenance is required. Your inquiries are invited—without any obligation on your part.

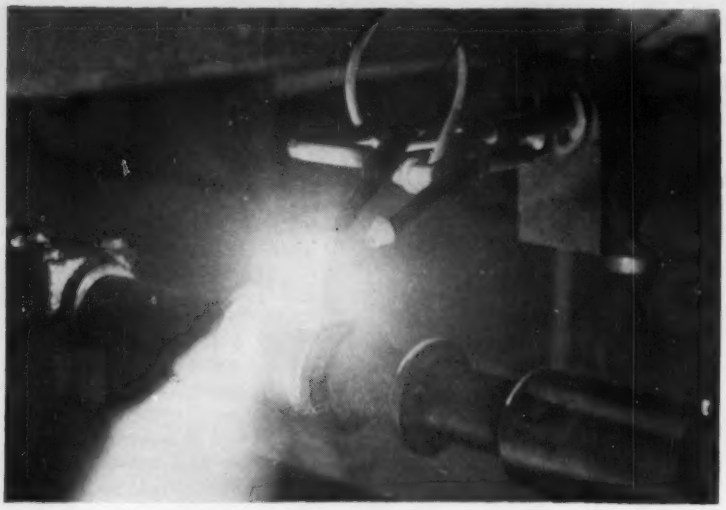
G&W ELECTRIC SPECIALTY CO.

7780 Dante Avenue, Chicago 19, Illinois

Representatives in principal cities of U. S. A.

Canadian Mfr.—Powerlite Devices, Ltd., Toronto, Montreal and Vancouver

CD561



Hydrogen Welding Stops Leaks

An atomic-hydrogen welding machine installed at Jefferson Products Co, Washington, Mo, is being used for the seam welding of filter shells. The intense heat of the tungsten arc, about 6,000F, fuses the metal and produces a homogeneous weld that eliminates leaks. This method has proved superior to other methods used because of the speed of operation, the uniform results obtained, and low operating costs. About 200 filter shells can be welded each hour.—Robert E. Enkelmann, Industrial Engineer, Union Electric Co of Missouri, St Louis.

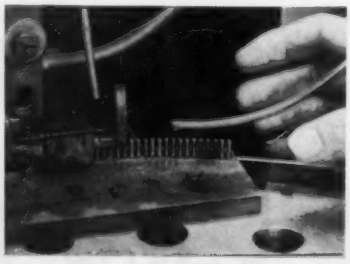
Induction Heater Anneals Special Plugs

An existing induction heater at Cannon Electric Development Co, Los Angeles, has solved an annealing problem involving a special type of plug for electronic applications. This not only improved product quality but also loaded the heater to full-time productive service.

Induction annealing of these plugs has reduced rejects substantially. Plugs were annealed formerly with a hand torch. This was slow, expensive, produced non-uniform results, and annealed almost the entire plug. Now only the ends of the plugs are annealed at the rate of 5,000 an hr.

In attaching leads to the special plug, one end is crimped. It is necessary to anneal this end, but not the entire plug. The 15-kw high-frequency induction heater applies heat uniformly only to the part to be crimped. Annealing is followed by a timed quench.

Another operation of the induction heater helps provide a better contact between male and female plugs. Before heat treating, female plugs are drilled and slotted longitudinally to form two segments. A quick and controlled heating of the contact end imparts a spring action to the segments. With heat-treating of plugs added to its regular job of silver soldering, the induction heater seldom is idle.



HIGH-FREQUENCY 15-kw induction unit anneals only the ends of tiny plugs

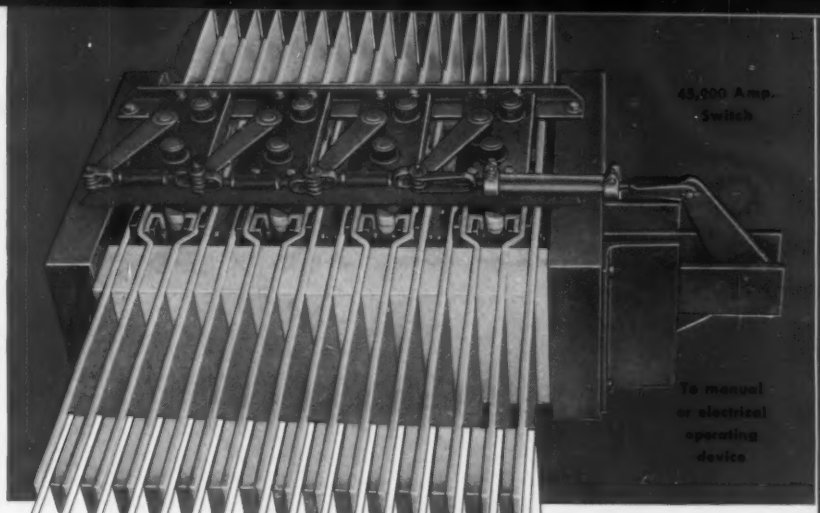
INDUSTRIAL BRIEFS

Transferring tallow from storage tanks to tank trucks is now being expedited at the St. Louis Hide and Tallow Co plant in St. Louis through use of electric heat. Tallow solidifies in the drain valves of the storage tanks during periods of inactivity, blocking the flow of tallow for succeeding shipments. Three 250-w strip heaters were spaced at regular intervals around each 3-in. valve. These heaters free the valve in 10 min on the coldest day. Previous method was to heat valves with burning oil-soaked rags, taking about 30 min to complete thawing. George C. Wagner, Industrial Sales Engineer, Union Electric Company of Missouri, St Louis, Mo.

Year-'round air conditioning has been obtained for a Texas bank even though winter temperatures threaten to freeze water in the cooling tower and its intake and discharge pipes. No damage will be done, however, because the City National Bank building has installed electric immersion heaters to prevent this. A 1,000-w, 220-v heater was put at each of the four corners of the 3,700-gal cooling tank. One inline thermostat switches on all units when air temperature drops to 30F. A ½-in. layer of felt insulation wrapped around the intake and discharge pipes assures free water flow to and from the tank. This arrangement enables 150 tons of air conditioning to be operated at any time to serve the building's lower floors. Harold E. White, Sales Engineer, Texas Electric Service Co, Wichita Falls, Texas.

Drying rinsed metal with an 18-kw bank of electric heaters, following an etching and degreasing process, has solved a problem at DeLuxe Game Corp, Wilkes-Barre, Pa. The metal "gym" sets formerly were rinsed in a steam heated caustic solution, but recently the solution has been cold because the steam source was cut off. The existing heaters, which dried the metal satisfactorily when a hot solution was used, no longer completely dried the metal. More heaters and a rearranged conveyor system has sped production through the degreasing, drying and painting stages, and has reduced manpower. Art Van Horn, Industrial Representative, Pennsylvania Power & Light Co, Wilkes-Barre, Pa.

HIGH CURRENT AC SWITCHING on R&IE INTERLEAVED BUS



Space Saving, In Line Mounted HIGH CURRENT SWITCHES

HIGH CURRENT, TYPE CR SWITCHES, mounted in-line with interleaved bus provide many design and operating advantages—

1. Save at least 60% space over conventional type disconnecting switches.
2. Can be mounted in-line with bus which is interleaved to reduce reactance.
3. Can be built, in single frame, for currents up to 60,000 amperes.

Operating advantages—

1. Operation at floor level regardless of elevation of switch.
2. Operating effort greatly reduced from that required of conventional blade switch of equal rating.
3. All contacts operate simultaneously with one continuous motion of operating handle.
4. Switch can be key interlocked with power source to prevent operation under load.

Send for descriptive bulletin No. 1220C.

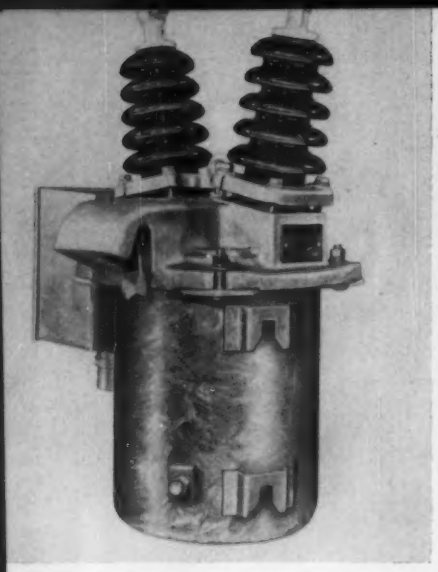
●

Consult the R&IE Division at Greensburg for planning, detailing and fabricating your AC, or DC bus.

R&IE EQUIPMENT DIVISION I-T-E CIRCUIT BREAKER CO. GREENSBURG, PA.

STRUCTURES—steel or aluminum ● TESTING DEVICES ● KIRK KEY INTERLOCK SYSTEMS ● ISOLATED PHASE BUS STRUCTURES ● INTERRUPTER SWITCHES

INDOOR BUS SUPPORTS and BUS FABRICATION ● OUTDOOR BUS SUPPORTS and AIR SWITCHES ● SUBSTATION



Load Pick-Up Switch

This voltage-sensitive load pick-up switch is designed to solve cold load pick-up problems on circuit breaker and recloser protected systems. Following a two-minute loss of system voltage, the switch automatically sheds the load it controls. It closes to pick up the load increment with time delay that is adjustable from one-half to five minutes following restoration of voltage. Inrush current can be held down by using different time delays and closing load pick-up switches on two or more feeders at different times.

The switch (Type LP) is rated 15 kv, 200 amp, and may be used for 2.3 to 14.4 kv, single or three phase. It can be supplied as a single-pole device for crossarm or direct-pole mounting.

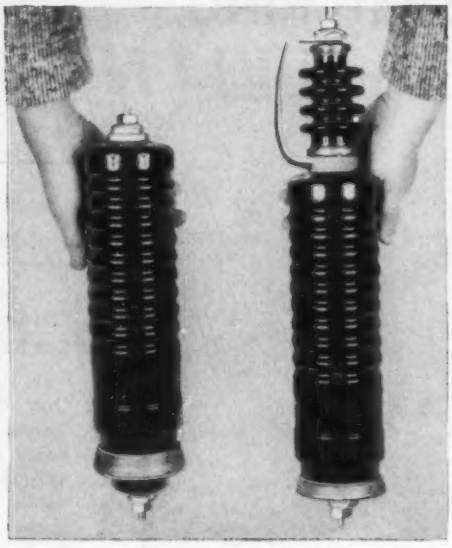
Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.

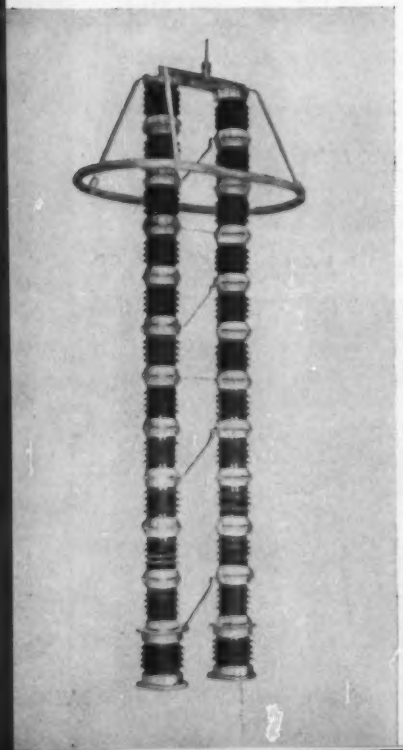
Lightning Arresters

New models of distribution and station-type lightning arresters were introduced recently.

• Thyrite magne-valve distribution arrester is designed for separate mounting. It utilizes magnetic action of series gaps and valve action of Thyrite disks.

There are two series of the distribution arresters: Direct-connected (left) with a ground-lead disconnector that separates arrester from circuit in case of arrester failure; and the external-gap series. Both are available in 9, 10, 12, 15 and 18-kv ratings. The 9-kv models are illustrated.





• Thyrite magne-valve station-type lightning arresters feature self-supporting construction and reduced height. Each single-pole arrester has two stacks of specially reinforced unit housings and insulating units connected in a zig-zag arrangement. Height is 25% less than the single-stack models of equal rating and no bracing or supporting steelwork is necessary.

The two-stack arresters are now available in 169, 182 and 195-kv ratings. Similar construction can be furnished in 121 and 145-kv ratings on request.

General Electric Co, Distribution Transformer Department. Pittsfield, Mass.

(*More New Equipment on page* 136)

Greater public safety...at new low cost to you

Hubbard's new Glo-Guard Guy Protector

Now you can get added protection for the public at a new low cost . . . with Hubbard's *Glo-Guard* Guy Protector. *Glo-Guard* has the added feature of luminous areas that reflect brightly in headlight glare. And the *Glo-Guard* is easily visible on dimly lighted streets or poorly lighted areas to warn pedestrians of dangerous projections.

Hubbard's new *Glo-Guard* Guy Protector is available in two lengths, 7 feet (Stock No. 718) and 8 feet (Stock No. 818). Attachment holes and clips are spaced for mounting on guy wires, rods or clamps at any height. It is formed from Cor-ten steel for long life and high strength.

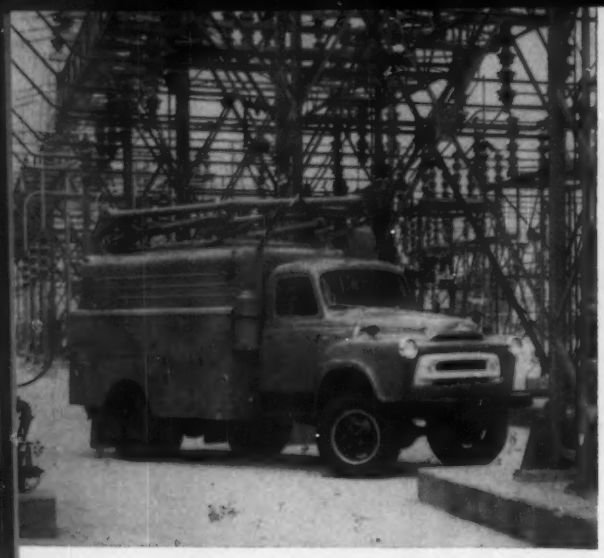
Glo-Guard is the latest addition to Hubbard's complete line of Guy Protectors. Also available is Hubbard's *Loxfast* Guy Protector. With only one bolt to tighten, the *Loxfast* is designed for fast installation and long years of service. *Loxfast* is available in 7 foot lengths (Stock No. 7657 Light and Stock No. 27657 Heavy) and 8 foot lengths (Stock No. 7658 Light and Stock No. 27658 Heavy).

Another Protector, popular with utilities, is Hubbard's *Half Round* Guy Protector. Edges of the *Half Round* are turned in for greater rigidity and safety. The *Half Round* is also available in two lengths, 7 feet (Stock No. 7557) and 8 feet (Stock Number 7558 for two bolts and Stock No. 7559 for three bolts).

For information on Hubbard's complete line of Guy Protectors, please contact your nearest distributor or Hubbard and Company, 6301 Butler Street, Pittsburgh 1, Pa.

HUBBARD AND COMPANY

Pittsburgh 1, Pa.
Chicago 50, Ill.
Oakland 8, Cal.



Utility-Body Truck

This four-wheel-drive truck with utility body has gross vehicle weight rating of 15,000 lb and is available with 154 or 172-in. wheelbase. Major features are: Standard engine—140-hp International Black Diamond 264; transmission—four speed with power take-off openings on both sides; transfer case—three-position-shift type.

The vehicle, Model S-160 (4 x 4), can be provided with full-torque power take-off at rear of input shaft. It has double-acting shock absorbers front and rear.

International Harvester Co, 180 N. Michigan Ave, Chicago 1, Ill.

Automobile-Truck

This vehicle is a station wagon with passenger car styling, but is built on a half-ton truck chassis. Manufacturer recommends it for utility use including off-the-road operations.

The vehicle, known as the Town Wagon, is offered in six and eight-passenger models. It provides maximum payload capacity of 1,650 lb and permits 90 cu ft of load space when carrying six passengers. Rear doors open to 50-in. width and 45-in. height.

A choice of a 169-hp V-8 engine or a 110-hp six-cylinder engine is provided.

Dodge Division, Chrysler Corp, Detroit 31, Mich.

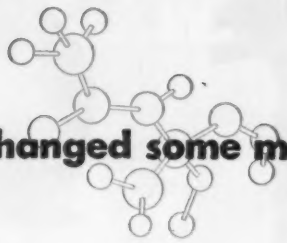
69-Kv Oil Circuit Breaker

A 69-kv outdoor oil circuit breaker (Type AJ-54) is rated 2,000 amp, 3,500 and 5,000 mva, with five-cycle interrupting time and 20-cycle reclosing time.

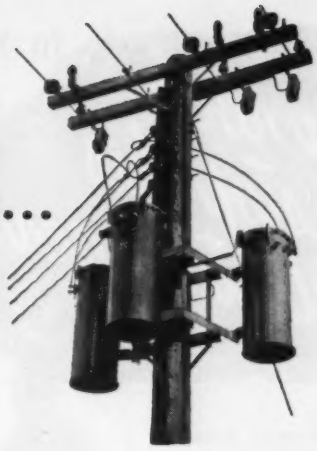
The oil-hydraulic accumulator-type operating mechanism is said to eliminate need for removing moisture or frost from lines. The mechanism provides direct line drive with main opening springs on pull-rod end and kick-off springs at each pole. Other features of the breaker include: Multi-set six-shoe sliding solid-silver to solid-silver contacts; wide separation of load break and arcing break; non-critical closed position adjustment; and interrupters without self-charged springs.

Federal Pacific Electric Co, San Francisco, Calif.

(*More New Equipment on page* 138)



Du Pont changed some molecules...



to produce the higher heat resistance of ALATHON®

polyethylene resin

From the Du Pont laboratories comes "Alathon" polyethylene resin with increased heat resistance for insulation and jacketing. This extra measure of protection for copper and aluminum conductors is in addition to other important properties, such as weatherability.

Jacketing of "Alathon" has outstanding dielectric strength. This material is lightweight and pliable; linemen find it easy to handle. Jacketing of "Alathon" provides real economy because it lasts for years without festooning or splitting. Another advantage is its low rate of water absorption.

For more property and application data on the family of Du Pont "Alathon" polyethylene resins, clip and mail the coupon below.

There is a difference in polyethylenes - specify ALATHON®

polyethylene resin

DU PONT

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.)
Polychemicals Department
Room 354, Du Pont Building, Wilmington 98, Delaware

Please send me complete information on Du Pont "Alathon" polyethylene resins. I am interested in evaluating these materials for.....

.....

*Name*_____ *Position*_____

*Firm Name*_____

*Street Address*_____

*City*_____ *State*_____

*Type of Business*_____

Even rocks won't stop this Tel·E·Lect digger!

- **Time Tested, Proven, Accepted**
- **Used by Public Utilities Everywhere**
- **Operates on Any Derrick Truck**
- **Nationwide Sales-Service Facilities**

Rugged construction from hardened steel auger to power take-off lets this time-tested Tel-E-Lect Pole Hole Digger work in all soil conditions . . . smart design lets Tel-E-Lect's digger reach up on hills, down into ditches, or across obstacles—anywhere up to 20 feet behind the truck!

Put this low cost, industry accepted unit on the front or rear of your utility truck . . . see your two-man crew dig a hole and set a pole in less than five minutes. The Tel-E-Lect digger will bore clean holes 10 feet deep. Interchangeable augers 8" to 20" in diameter are offered.

The digger is lifted by truck's boom and winch. Engine power is delivered to the digger through a telescoping drive shaft and the auger can be rotated in either direction by shifting the PTO.

All Tel-E-Lect products are sold and serviced through a nationwide distributorship plan. You'll find your local dealer listed under "Trucks-Equipment" in the yellow pages, or *write direct for complete information.*

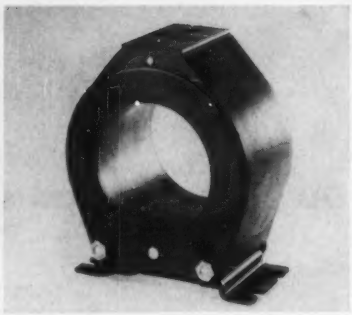
This 2-man utility truck is completely equipped by Tel-E-Lect. Its derrick and digger are stowed overhead for travel.

Once on the job, the derrick and digger are raised automatically with the winch . . . no need for a big crew with this compact unit.

In two minutes the Tel-E-Lect derrick and digger are in position, ready to work. Note that the pole is used as additional weight to force the auger into the frozen ground.

Tel·E·Lect PRODUCTS, INC.

10,003 Minnetonka Boulevard Minneapolis 26, Minnesota



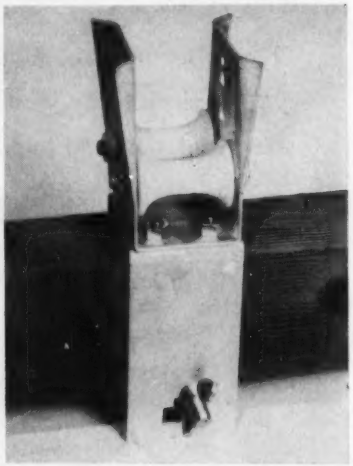
Instrument Transformer

This 600-v butyl-molded window-type instrument transformer is designed for indoor switchboard and switchgear applications.

The unit, known as JCS-O, is available in all standard ASA current ratings from 200:5 to 4,000:5 amp. Frequency is 50/60 cycles, and thermal rating is 100% of rated current with 55C ambient and 133% of rated current with 30C ambient.

Two window diameters are provided: 4½ in. for 200:5 to 600:5-amp ratings; and 5⅜ in. for 800:5 to 4,000:5-amp ratings. The molded butyl of the 28-lb JCS-O serves as both insulation and case.

General Electric Co, Schenectady 5, N. Y.

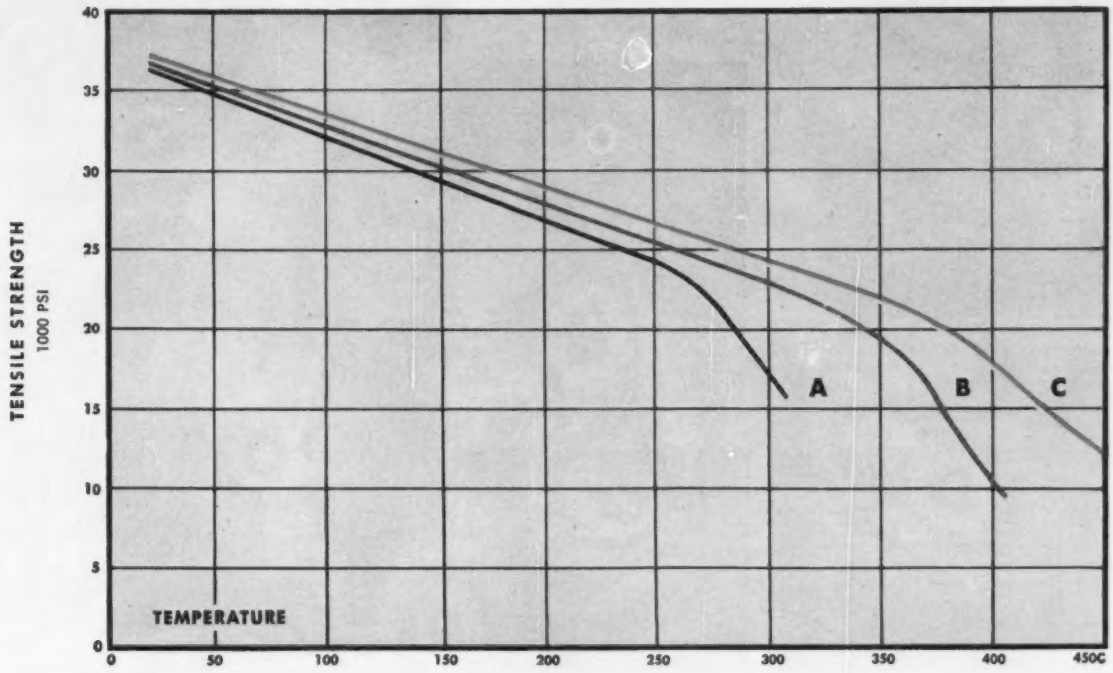


Cable-Stringing Blocks

Universal cable-stringing blocks equipped with Dupont molded nylon spools are designed for applications with large aluminum or copper conductors, weather-proof cables, cable

(Continued on page 142)

How silver helps copper conductors at elevated temperatures



THE INFLUENCE of silver on the tensile properties of high-conductivity copper at elevated temperatures. Tests made by the Metallurgical Research Laboratory of The American Brass Company. The test pieces were copper strips, cold-rolled to a temper approximately that of hard-drawn rectangular bus bar.
A. Electrolytic copper, silver content normal
B. Electrolytic copper, silver 8.7 ounces per ton added
C. Electrolytic copper, silver 28 ounces per ton added

In heavily loaded motors and generators, the windings, collector rings, and commutators must retain their strength at the higher operating temperatures that have become the rule. And there are now many other places where copper conductors must operate at temperatures well above those heretofore considered normal.

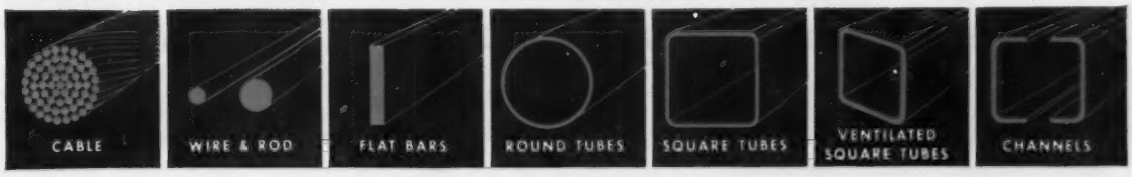
Electrolytic copper—with a very small amount of silver added—is superior to any other commercial conductor metal for use at these higher temperatures. Anaconda silver-bearing copper retains the structural design strength of the conductor at the higher operating temperatures. Annealing temperature is raised and softening delayed. The margin of safety is improved. How much gain you can count on is indicated by the chart above.

More complete information is available in the brand-new Fifth Edition of The American Brass Company's Publication C-25, "Anaconda Copper for Electrical Conductors." In addition, this 62-page booklet has convenient new tables giving physical and electrical data on all types of rigid bus conductors for the most commonly used sizes—plus a wealth of general information on the properties of copper conductors.

TECHNICAL SERVICE. The assistance of Anaconda specialists in the selection of conductors to meet your special problems is available to you. For such assistance — or to get a copy of "Anaconda Copper for Electrical Conductors" — see your nearby Anaconda representative. Or write: The American Brass Company, Waterbury 20, Conn. 56100

ANACONDA® **COPPER CONDUCTORS**

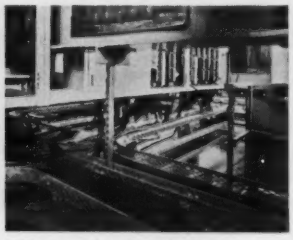
THERE'S AN ANACONDA ELECTRICAL CONDUCTOR FOR EVERY NEED



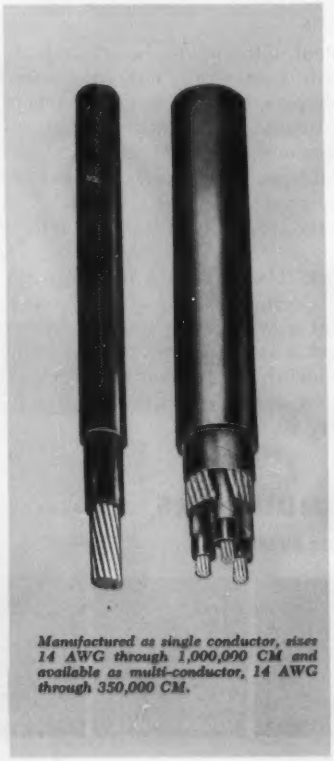
For residential and rural electrification, RoMarine-RoPrene is the answer for service entrance as well as branch circuits between buildings.

Several miles of single-conductor, RoMarine-RoPrene street lighting cable was recently installed at Redwood Falls, Minnesota. This cable was installed underground in ducts. Insert shows completed lighting installation.

Consolidated Edison (and other leading utilities) uses RoMarine-RoPrene for its vast underground power cable secondary network in New York City.



Where you install cable in racks, trays or metal raceways, specify RoMarine-RoPrene. Its light weight and smaller diameters will make your job easier.



Manufactured as single conductor, sizes 14 AWG through 1,000,000 CM and available as multi-conductor, 14 AWG through 350,000 CM.

To light the Ft. Worth International Airport, 55 miles of CAA approved RoMarine-RoPrene single-conductor cable (rated at 3000 volts) was buried directly in earth.

One all-purpose

If you are one who has anything to do with the distribution of low-voltage power—underground, aerially, in ducts or in circuits combining all three—this is for you!

RoMarine-RoPrene is an all-purpose nonmetallic sheath power cable you can use for street lighting, power cable networks, airport lighting, utility, industrial or commercial power distribution, residential services and rural electrification.

This product of Rome research and engineering has proved its superiority in so many ways you can bank on it without reservation.

RoMarine is a high-quality heat- and moisture-resistant insulation (RH-RW) exhibiting exceptional electrical stability after long-time immersion in water together with excellent long-life aging characteristics. RoMarine conforms to all requirements of ASTM Specification D754-54T, plus the additional moisture absorption tests as specified by

cable for all these applications!

Underwriters and IPCEA Appendix N.

RoPrene is a tough, impervious Neoprene sheath fitting tightly to the insulation and possessing a high degree of resistance to oxidation, heat, flame, weather, oil and most chemicals. RoPrene conforms in all respects to ASTM Specification D752 and Grade I of IPCEA, Appendix K.

RoMarine-RoPrene is available in two distinct types with respect to application and operation, namely, Style RR and Style RR-D.

RoMarine-RoPrene approvals

- RoMarine-RoPrene, Style RR.

This is Rome Cable's standard product, manufactured with sheath thicknesses suitable for *direct earth burial*, and is equally suitable for use in conduit or duct, as well as aerial installation where greater protection against cable rings or binding wires is desired. It is Underwriters' approved as Type USE for underground service entrances and is so labelled and surface marked.

- RoMarine-RoPrene, Style RR-D.

This type construction is offered for use in ducts or underground conduits as an economical power cable manufactured with the same high-quality insulation, but with lighter sheath thicknesses. While approved by Underwriters' Laboratories Inc. and identified as Type RW (60°C.)–Type RH (75°C.), this construction *is not recommended for direct earth burial.*

CAA Specification L-824

RoMarine-RoPrene, Style RR is approved by the Civil Aeronautics Administration for airport wiring when CAA Specification L-824, with Type A insulation applies.

Check these RoMarine-RoPrene advantages:

When you specify RoMarine-RoPrene you get the double protection of a superaging, heat- and moisture-resistant insulation . . . and an all-resistant Neoprene sheath. *Plus these advantages . . .*

- Easy to splice and tap
- Good resistance to overloads
- Light weight and small diameters
- No braids or fibrous coverings to rot
- Unaffected by electrolysis, corrosion and weather exposure
- Resists oils, heat, sunlight, flame, moisture, abrasion, as well as soil alkalies and acids
- You save in installation costs
- You reduce inventory

For more detailed specifications, write for Bulletin RR-2.

It Costs Less to Buy the Best

ROME CABLE Corporation
ROME · NEW YORK
and
TORRANCE · CALIFORNIA

Long Island Lighting Company Makes

PERMANENT

Moisture-Proof

SPLICES

with

BISHOP No. 30 HIGH VOLTAGE SPLICING TAPE

A Long Island Lighting Co. splicer starts taping 5 Kv joint with No. 30 High Voltage Splicing Tape.

He wraps continuously with firm tension, half-lapping the tape to insure moisture-proof fusion of tape layers.

The No. 30 primary insulating tape is built up to approximately 1½ times the original cable insulation. After taping is completed a lead sleeve is wiped on both ends.

Long Island's vast network of parkways carries one of the greatest concentrations of vehicular traffic in the world. Safe driving on these busy roads relies heavily on safe lighting. The Long Island Lighting Company uses Bishop No. 30 High Voltage Tape as one of the approved tapes for important splicing jobs like the underground 5 Kv parkway series lighting cable splice shown in the photographs.

No. 30's exceptional resistance to the erosive action of corona and ozone, plus its excellent aging qualities, insures a lasting splice. It fuses into a homogeneous, moisture-proof wall which equals or betters the original insulation. No. 30 is used as the primary insulating tape for splicing high voltage cables operating up to 15 Kv and having conductor temperature ratings of 85°C. It far exceeds A.S.T.M. specifications.

Complete technical data on No. 30 and other Bishop tapes for cable splicing is yours for the asking. Write us today!

MORE THAN A CENTURY OF BISHOP ELECTRICAL INSULATION

BISHOP MANUFACTURING CORPORATION

6 CANFIELD ROAD

CEDAR GROVE (ESSEX CO.) N. J.

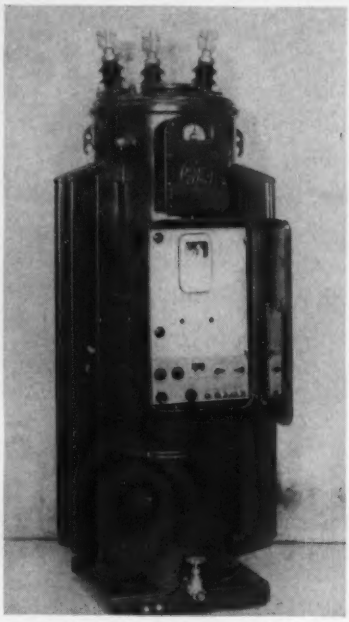
Cable-Stringing Blocks

(Continued from page 138)

supports, aerial cable supports, and bus supports.

The blocks are adjustable to fit all standard cross arms. Manufacturer claims the product protects cross arms, cables and insulating sheaths from chafing, and protects stringing personnel by controlling position of cable.

Distribution & Hi-Line Specialties Co, 2100 Del Norte, St. Louis 17, Mo.



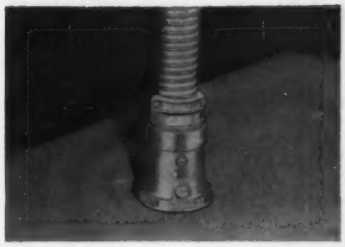
Induction Regulators

Two oil-filled induction regulators replace nine previous station ratings. The new units are termed RM (repetitive manufacture) regulators. They employ standardized designs and mass production methods to provide the same design features as the previous line of regulators.

Manufacturer claims the units utilize an improved winding method which cuts handling in manufacture, increases insulation life, and reduces the size of the rotor assembly.

The 125-kva, 2,500/5,000-v RM unit supplants seven old ratings from 62.5 to 125 kva. The 114.3-kva, 7,620-v RM unit replaces two previous 114.3 and 76.2 kva ratings.

General Electric Co, Schenectady 5, N.Y.



Armored Cable Fitting

This armored cable terminator is designed to simplify installation when varnished cambric or rubber insulated armored cable must be compound sealed at the termination of a run. The flared body of the fitting gives wide conductor spacing and thorough penetration of the filling compound into the crotch of the cable.

The terminator (Type ACSW) is supplied with all components plus filling compound. It is available in sizes to fit armored cable from approximately 2 to 3½-in. diam. For additional data, request Form NP3M2-56.

PLM Products, Inc, 3871 W. 150 St, Cleveland 11, Ohio.

Mercury-Vapor Lamps

Two mercury-vapor lamps were introduced recently. They are:

• Silver-White—for residential street lighting and for industrial illumination. Manufacturer claims the lamp offers improved color characteristics and 10 to 20% added light output. Bulb coating is known as Orthophosphate and reportedly gives the sensation of silver-white light by emitting color over the entire visible spectrum.

The silver-white lamp is available in 100, 175 and 400-w regular bulb sizes and in a 400-w reflector type.

• Golden—for lighting intersections, curves, railroad crossings, and similar "slow-down" traffic spots. The lamp's attention-getting golden color is designed to warn drivers that caution is required. Manufacturer also recommends the lamp for decorative building floodlighting.

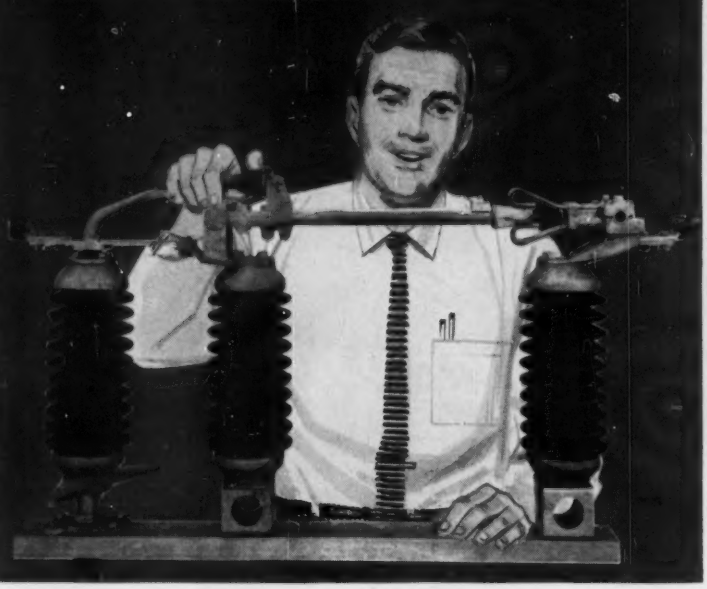
The lamp derives the golden effect through the combination of a special phosphor and coating. It is produced in 400-w size initially.

Sylvania Electric Products, Inc, 1740 Broadway, New York 19, N. Y.

(More New Equipment on page 144)

Give the GUY a CHANCE
MIKE THE MOLE KNOWS WHAT GOES ON BELOW "SEE LEVEL"
CHANCE 8-WAY ANCHORS
It's not surprising that in every field test the Chance 8-Way Expanding Anchor holds more than its rated load because its design just makes common sense. Eight blades expand to form a pyramid shaped square —there is no wasted space between blades. The load is distributed evenly—all around the hole. It just seems logical that it should hold more, and it does. That's why it's on so many company standards. Your Chance Anchor Distributor can supply you from stock. Specify Chance for Service!
EXTRA! EXTRA!
Here's good news for your guys! Read all about it in "Anchoring." Yours for a post card!
"ANCHORING" is the most complete guide to anchoring and guying ever developed. Shows how to choose the right anchor for every job—and how to install it right.
A·B·CHANCE CO·
CENTRALIA, MISSOURI
San Francisco, California
Pittsburgh, Pennsylvania

"After all, is there really much difference in switches?"

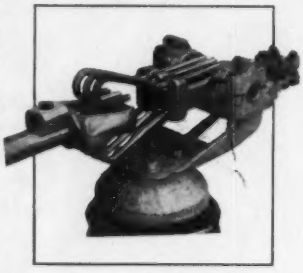


There certainly IS! Here's why

When you install a switch, it *must* be built to last—for years. Quality of materials and simplicity of operation are the keys to long life—and they're found in *every* Royal switch. For example, the VVL vertical break shown here has only 10 separate parts above the insulators in the final assembly of each pole — fewer moving parts for rugged, reliable operation.

The Royal VVL switch was the *first* to eliminate the use of braid shunts on the hinge contact, further simplifying operation. Permanently sealed aircraft type lifetime bearings eliminate maintenance. Future ground switch installation on all Royal switches is accomplished without completely dismantling the main switch.

EVERY ROYAL SWITCH EXCEEDS MINIMUM STANDARDS IN *EVERY* RESPECT. Make a date to see a Royal switch "in person"—Write today.



High pressure contacts

Over **50 lbs.** of pressure on each Beryllium copper contact rod mean high pressure wiping contacts, minimum resistance, and positive electrical connections.

ROYAL

A part of the arsenal of AMERICAN POWER PRODUCTION

ROYAL ELECTRICAL MANUFACTURING CO., INC.
1122 EAST 87TH STREET • CHICAGO 19, ILLINOIS
Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices

'All Electric Home Socket'

This square socket is designed for use with all watthour meters having capacity of 100 amp or less.

The Type S-1 socket is designated "the all electric home socket." Its terminals are located symmetrically for vertical or horizontal mounting. Each terminal block assembly is secured by two screws to simplify conversion from vertical to horizontal mounting.

Features of the product include: Die-cast aluminum construction; drain track and "weep-holes" for passage and escape of moisture; die-cast hub construction; and cover-locking device which utilizes a slide bar sealed in position by standard sealing ring.

The S-1 socket is about 8¼ in. square with inside volume of 144 cu in. Over-all depth of the 3-lb socket and cover is 3 $\frac{5}{16}$ in.

General Electric Co, Meter Department. Somersworth. N. H.

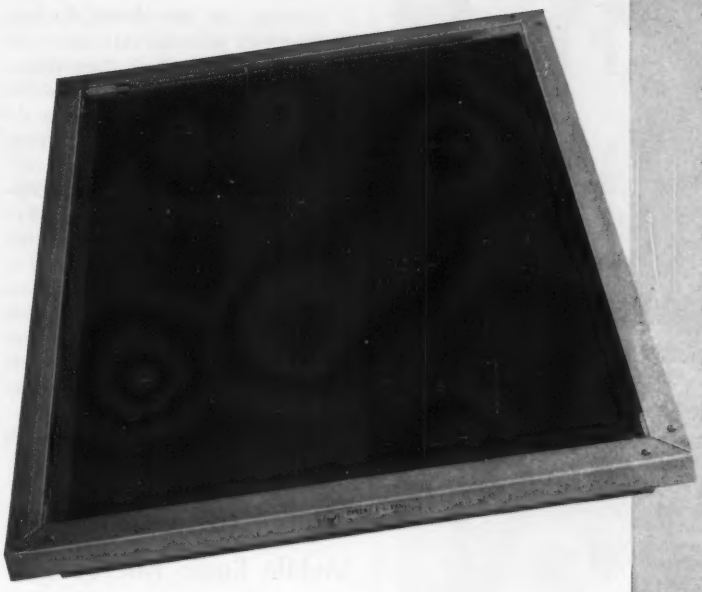
One-Shift Truck Axle

Difficulties of off-the-road trucking operations are reportedly lightened by a new rear axle known as a wide-range, one-shift axle. It is available in a 1956 truck line.

The axle can be used with either Hydra-Matic or manual gear-shift transmissions. Both high and low ranges are spaced to permit obtaining progressive gear combinations with only one shift. When combined with manual transmissions, the axle eliminates split-shifting. It has low-gear ratio with 18:1 reduction.

General Motors Corp, Truck and Coach Division, Pontiac 11, Mich.

(*More New Equipment on page* 146)



*

Sales Feature . . . **Uniform Heat**

The entire surface of our panel radiates heat.

Sales Feature . . . **Economy**

Efficiency up to 80% means minimum operating cost—makes electrical heating practical for large areas.

Sales Feature . . . **Safety**

No glowing wires or coils—and there's no water needed. PYREX brand glass is strong.

Sales Feature . . . **Cleanliness**

Corning panels don't attract dust—have no combustion waste.

Sales Feature . . . **Comfort Control**

Each room can have the amount of heat it needs right to the degree.

Sales Feature . . . **Fast Heat**

Corning panels radiate infrared rays that convert to warmth fast.

Sales Feature . . . **Silence**

No moving parts.

Sales Feature . . . **Space Saving**

A complete unit need be only 2 or 3 inches deep.

Sales Feature . . . **Easy Installation**

You can design heaters with Corning Radiant Panels for installation with no complicated wiring or wall preparation.

Sales Feature . . . **Pre-Acceptance**

Consumers know that the PYREX trade-mark identifies dependable value. This helps you gain high acceptance with a new product — right from the start—with consumers, dealers, distributors.

PYREX E-C panel's sales features are helping to create wider acceptance for electric heating

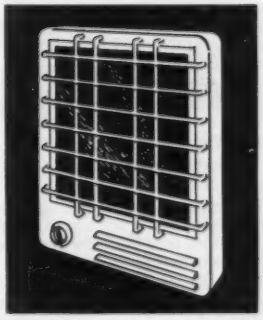
Take all the reasons for having electric heat. Add to them the sales features of the PYREX E-C panel.

You'll have a doubly-impressive collection of features to build demand for electric heat installations in new homes . . . additions . . . expansions . . . auxiliary heating . . . emergency heating . . . and portable heating.

The PYREX E-C panels supply the sales edge in the way they perform. We make them of a PYREX brand glass with a conductive, metal oxide coating bonded to the back surface. They emit infrared energy with a high degree of efficiency. They're mechanically strong and thermally rugged. And their electrical characteristics are excellent. They can be used as high temperature, 2,000- and 3,000-watt units for permanent space-heating installations. Also current surge on starting is low.

To learn all about Corning PYREX E-C Panels and how you can use them to increase the use of electric heating, write, wire or phone Corning Glass Works.

If you are interested in using these PYREX E-C panels as components in new heaters, we'd be delighted to talk it over with you.



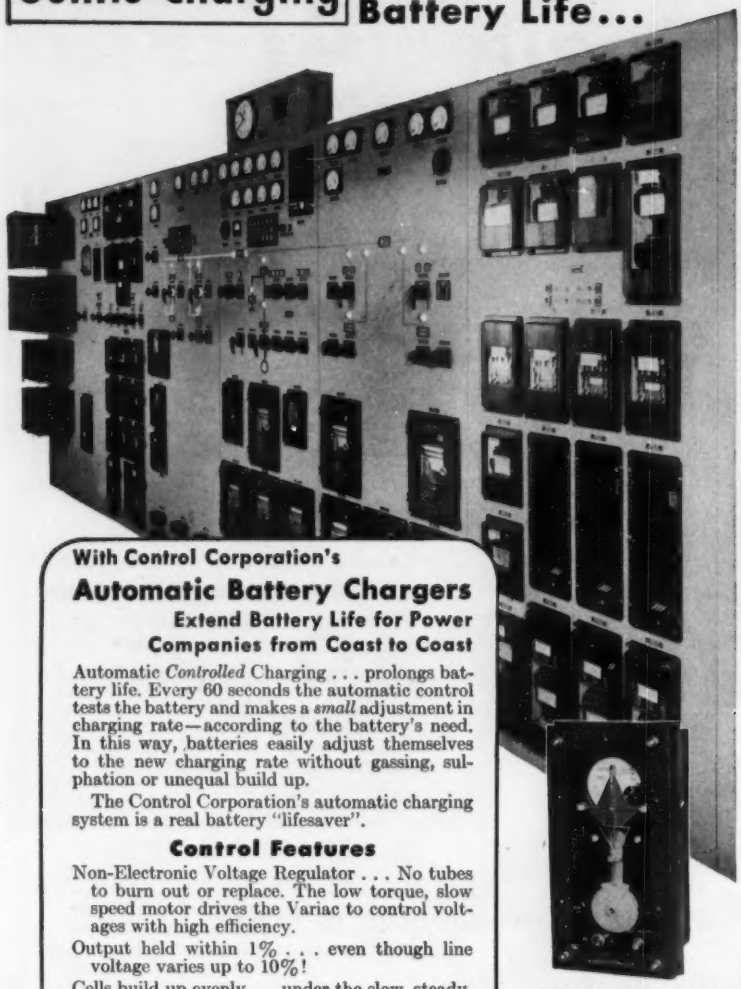
Standard panel sizes: 8" x 36", 12" x 16" and 16" x 24" are available. Other sizes to order.

CORNING GLASS WORKS, CORNING, N. Y.

39-4 Crystal Street

Corning means research in Glass

Gentle Charging for LONGER Battery Life...



With Control Corporation's

Automatic Battery Chargers

Extend Battery Life for Power Companies from Coast to Coast

Automatic *Controlled* Charging . . . prolongs battery life. Every 60 seconds the automatic control tests the battery and makes a *small* adjustment in charging rate—according to the battery's need. In this way, batteries easily adjust themselves to the new charging rate without gassing, sulphation or unequal build up.

The Control Corporation's automatic charging system is a real battery "lifesaver".

Control Features

Non-Electronic Voltage Regulator . . . No tubes to burn out or replace. The low torque, slow speed motor drives the Variac to control voltages with high efficiency.

Output held within 1% . . . even though line voltage varies up to 10%!

Cells build up evenly . . . under the slow, steady, controlled charging rate.

Lifetime Selenium Rectifiers . . . chosen for their exceptional dependability and long life. Rectifiers are convection cooled and protected thermostatically for utmost dependability.

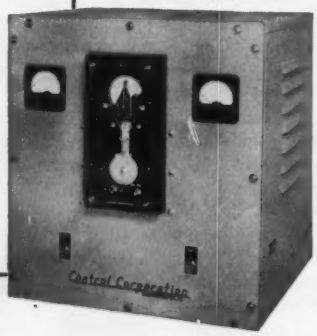
Top Quality Components . . . each one chosen for its proven service, long life and dependability.

Three Way Protection:

- Overcurrent protection . . . with air type circuit breakers.
- Thermostatic protection . . . another plus safety feature to assure controlled output under abnormal load conditions.
- 1500 volt Hi-Pot . . . gives complete protection and excellent isolation.

Behind the scenes...

The heart of the Control Corporation's Automatic Charger which selects the Best charging rate every 60 seconds . . . it's a real battery lifesaver!



CONTROL CORPORATION
719 Central Ave., N. E. Minneapolis 14, Minn.

Control Corporation
The nameplate of Quality MINNEAPOLIS

• Super-Trol • Peak-Trol • Telemetering • Battery Chargers • Carrier Current

Fusible Service Entrance

Plug-in construction is featured in a new fusible service entrance device. The new construction is said to make it possible to obtain the proper circuit combination for any job, regardless of the number of 110 and 220-v loads needed.

Features of the device include: Barrier with twistouts that covers entire bus structure; flush door with a latch which may be replaced with a panel-type flush lock; packaging designed for flexibility and simple stocking at local levels.

Basic devices are available with 200-amp main pullout and space for 28 or 40 plug fuse branches. Plug-in branch circuits are of two types, plug fuse or 30 and 60-amp pullouts. Pullouts are designed to fit the space of 4 plug fuses, and any combination of pullouts and plug fuses is available. Complete information is contained in Bulletin SD-36.

Square D Co, 6060 Rivard St, Detroit 11, Mich.

Mobile Radio Microphone

Transistorized dynamic microphone for mobile two-way radio applications reportedly provides clear, crisp voice reproduction.

The development is also available as a dual-purpose dynamic "speaker-mike" which functions both as a full-output communications-type loudspeaker as well as a dynamic microphone. High ambient noise is overcome by mounting or holding the unit near the operator's ear.

Motorola Communications & Electronics, Inc, 4501 W. Augusta Blvd, Chicago 51, Ill.

(More New Products on page 148)

MORE NEW PRODUCTS

T. J. Cope, Inc, Collegeville, Pa., has a **conduit-cleaning tool,** known as the Jar Hammer, for use with all types of cutters for removal of heavy silt, cement, and other obstructions. The tool, which delivers a blow directly at the cutting tool, is made of 2-in. steel tubing with heavy piston and hammer working inside the cylinder on a 12-in. stroke.

International Fermont Machinery Co, Inc, Ramapo, N. Y., has a **1-kw emergency power plant.** The 88-lb basic unit is manual starting, 2 wire, 60 cps, ac, single phase.

Ingersoll-Rand Co, 11 Broadway, New York 4, N. Y., has added a 900-cfm unit to its line of Gyro-Flo **compressors.** The 14,340-lb unit delivers at 100 psi.

Sterling Electric Motors, Inc, 5401 Telegraph Road, Los Angeles 22, Calif., offers a line of **explosion-proof motors** through NEMA frames 405 and 215.

Minnesota Mining & Mfg Co, St. Paul, Minn., has a **h-v splicing tape,** Scotch brand No. 23 electrical tape. The self-bonding tape has dielectric strength of 650 v per mil.

Cornell-Dubilier Electric Corp, South Plainfield, N. J., has two types of high-capacity **ac motor capacitors.** Type KNT is rated from 40 mfd at 236 v to 25 mfd at 440 v; Type KXT, from 30 mfd at 236 v to 20 mfd at 440 v.

General Radio Co, 275 Massachusetts Ave, Cambridge 39, Mass., has an **impact-noise analyzer** (Type 1556-A) to simplify measurements of impact noises.

Davis Emergency Equipment Co, 47 Halleck St, Newark, N. J., has a ribbed alloyed **aluminum safety hat.** It reportedly resists impact in excess of 40 ft-lb, and will not crack or break when dropped.

Champion DeArment Tool Co, Meadville, Pa., has a dual-range **utility wire cutter.** The 3-lb cutter can handle 7/8-in. insulated wire and 5/8-in. copper wire when operating in large range.

MIF

malleable iron

HIGH CORROSION RESISTANT

Aerial Cable Clamps

Field tested and engineer approved on the basis of:

SIMPLICITY:
One unit—no separate clamp, spacer or pole plate.

VERSATILITY:
Can be used on both tangent and up to 90 degree angle structures.

CLEARANCE:
Eliminates chafing and abrasion of cable against pole.

COST:
Lower initial cost—fewer pieces to buy, inventory, handle and install.

Recommended by major cable manufacturers.

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For further information write for Bulletin PH2

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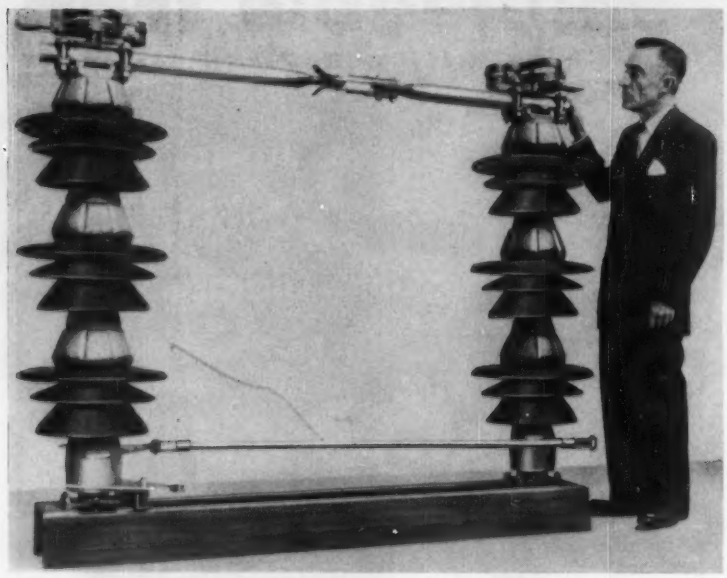

Federal Pacific Develops Experimental Aluminum Switch

An experimental high-voltage switch, utilizing aluminum in its structural members, has been designed and developed by the Pacific Switchgear Division, Federal Pacific Electric Co. This was disclosed recently by R. W. Hutchinson, product sales manager. The 115-kv, 600-amp switch members were designed and constructed of aluminum under the direction of R. F. Gibbons, who is shown observing the design. He was formerly manager of air-break switch engineering at Federal Pacific's Santa Clara, Calif., plant, and is now general manager of the company's Gardner Transformer Division which is at Emeryville, Calif.

"Object of the experimental switch project," Hutchinson said, "was to develop practical engineering design in view of the present and probably continuing advantages of cost and availability of aluminum over copper."

This experimental single-pole switch, Gibbons explained, was built on a base of welded aluminum structural sections. Bearing housings, crank levers and inter-tie rods near the base are aluminum material. Top hardware is provided by aluminum castings. Switch blade is annealed aluminum tube with flattened ends. Nuts and bolts are aluminum alloy.

Known as type YVH, this switch retains copper and copper alloys for flexible conductors, contact springs and clip contact shoes. Tongue contacts have solid-silver inserts brazed to copper pads which are soldered to the copper plated flattened end of the aluminum blade. Connections between flexible copper conductors and aluminum hinge castings are made by means of copper-aluminum bimetals. Except for switch contacts, a corrosion-preventive grease is applied to screw threads and all electrical transfer points, Gibbons pointed out.

This new development is to be exhibited for the first time at the annual convention of the American Public Power Association, April 24 to 26, at the Biltmore Hotel, Los Angeles, Calif.

Byron Jackson Building Large Pump for Con Ed

Byron Jackson Division of Borg-Warner Corp, Los Angeles, Calif., is building a 6,330 gpm boiler feed pump for the Consolidated Edison Co. According to BJ engineers this pump will be at least twice as large as any boiler feed pump now in existence in this country.

This pump, rated at 12,000 hp, is to deliver 6,330 gpm at a total dynamic head of 6,400 ft, or about 2,700 psi at a speed of 3,510 rpm. The unit is the BJ double case barrel type feed-pump.

The pump will be used with the Astoria No. 3 turbine generator. The utility's engineers are employing a new concept of drive—the main generator steam turbine. Power will be transmitted through an American Blower Corp fluid drive coupling for variable speed operation to meet load conditions.

Foster Wheeler to Build Ridgefield Station Boilers

Foster Wheeler Corp, New York, has been awarded a contract to furnish two steam generators for a new power plant to be constructed by Public Service Electric & Gas Co at Ridgefield, N. J., according to H. B. Wallace, manager of steam sales for Foster Wheeler.

Each steam generator will furnish 1,900,000 lb of steam per hour at 2,725 lb per sq in. gage design pressure, 1,100F primary steam temperature and 1,050F reheat temperature. The units are of twin furnace natural circulation design. Fuel will be pulverized coal.

Completion of the $11 million contract is scheduled for 1958.

Big Metals Stock Switch

Phelps Dodge Corp has purchased 95,000 of the 195,000 shares of common stock of New Jersey Zinc Co held by St. Joseph Lead Co. St. Joseph will use the proceeds in a zinc smelting expansion program.

(*More M&M on page* 152)

"You Get Extra Battery Performance -

America's Finest!
GOULD PLANTÉ
The Aristocrat of
Stationary Batteries

The MATERIAL HANDLING INSTITUTE'S EXPOSITION
Cleveland, Ohio
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Your Gould Field Engineer's one job is to see that you get maximum service from your batteries. He is factory-trained to instruct your own men as to correct maintenance routines and to help set up a simple record system for anticipating battery needs.

There's a Gould Field Engineer in your area. He's as near to you as your telephone. Call him. And when you see him, ask him for the new Gould Plus-Performance Plan material for your battery maintenance staff.

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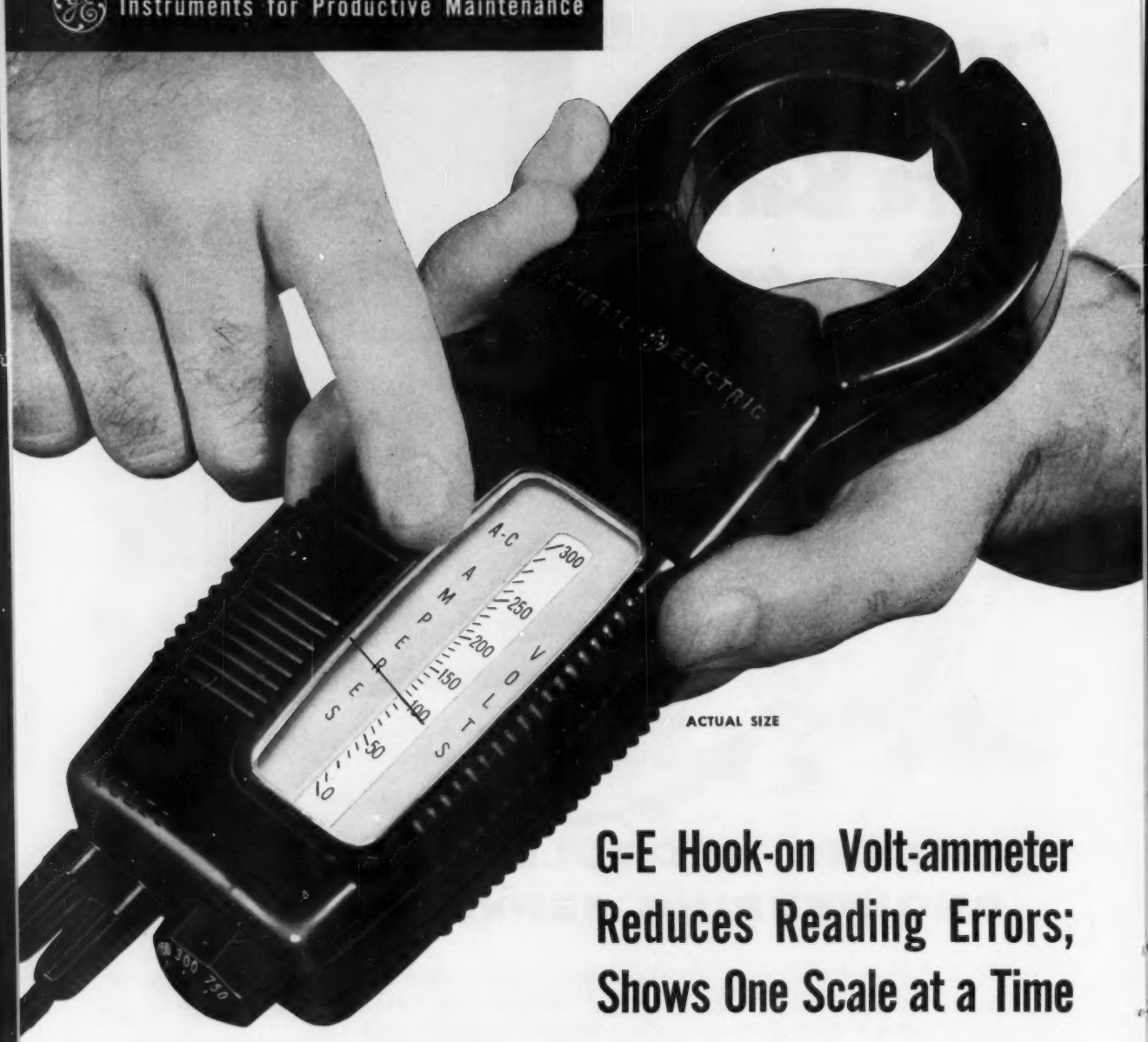
Instruments for Productive Maintenance



ACTUAL SIZE

G-E Hook-on Volt-ammeter Reduces Reading Errors; Shows One Scale at a Time

GENERAL ELECTRIC'S hook-on volt-ammeter shows only one scale at a time. You simply select the desired range and only the corresponding scale is visible. This eliminates the possibility of reading the wrong scale, as can be done with multiple scale face instruments. The range and scale of this G-E instrument are changed simultaneously by turning the finger-tip control knob. The two models of the instrument are designated Types AK-4 and AK-5, and both have current scales marked in black and voltage scales marked in red.

USED BY contractors, electricians, engineers, maintenance and servicemen, the G-E hook-on is ideal for balancing circuits and tracing faults and grounds without shutting down equipment.

WIDE RANGES are available in both models of the G-E volt-ammeter. Ranges of the AK-4 model are 0-10/30/-100/300/800 amperes and 0-150/300/750 volts. The AK-5 ranges are 0-5/20/80/350 amperes and 0-150/-300/750 volts. The wider range AK-4 model has a pointer-stop to check surge readings.

FOR FURTHER INFORMATION, write section 582-10, General Electric Co., Schenectady 5, New York and ask for bulletin GEA-6292, or contact your nearest G-E Apparatus Sales Office.

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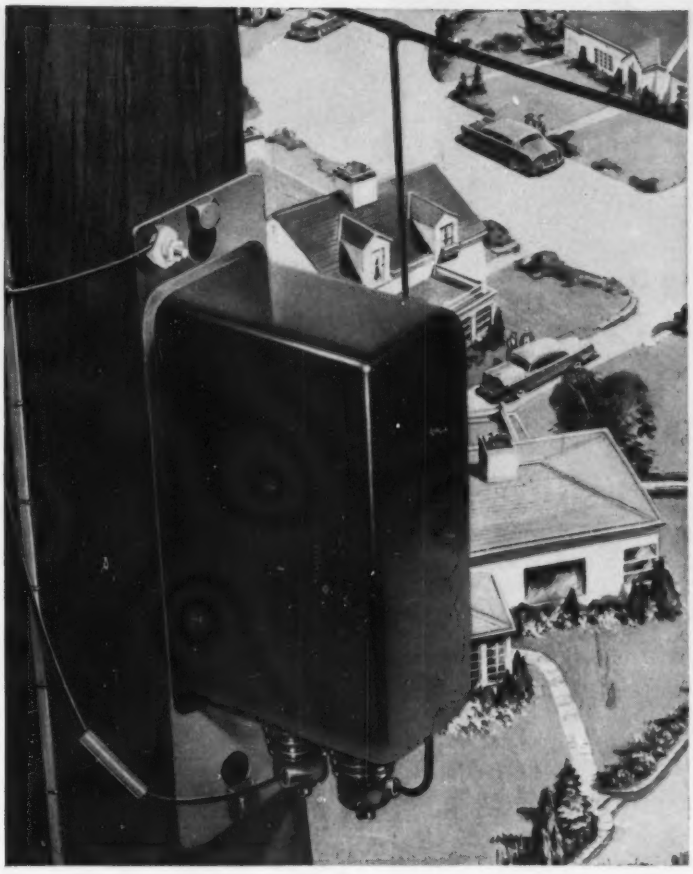
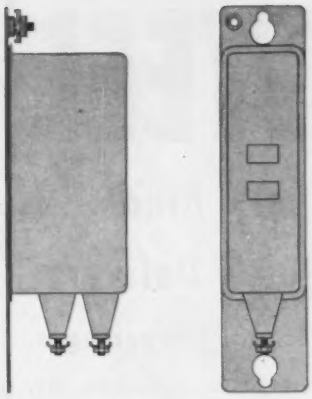
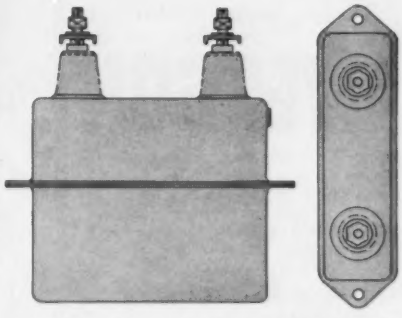
GENERAL ELECTRIC





OUTLINE OF 3 AND 5 KVAR UNITS



OUTLINE OF 7.5 AND 10 KVAR UNITS

Now is the time to plan for '56 summer loads

Order your G-E residential secondary capacitors now and avoid costly, last-minute, rush installations

The increased use of residential cooling equipments means two things:

1. Summer system overloading, voltage problems, and low power factor.
2. The need for residential secondary capacitors at the first sign of hot weather.

We suggest that you plan your purchases now to include the secondary feeder units that you'll need on your lines next summer. Early planning and ordering will help you avoid possible summer system over-loading—and you'll be assured of having capacitors when you need them.

General Electric residential capacitors are available in 3, 5, 7.5, and 10-kvar ratings to meet your varying needs. Whatever the rating, G-E units are built to be installed and forgotten.

Long capacitor operating life is assured through the use of G-E pioneered low-loss kraft paper which holds temperature rise to a minimum—an important factor in correcting "heat wave" load problems.

Your local G-E Apparatus Sales Representative can help you plan your residential capacitor needs now. And for more detailed information on the capacitors, just write for Bulletin GEA-6186, to Section 441-31, General Electric Company, Schenectady 5, N. Y.

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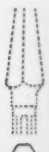
NEW IRWIN 2-WAY "Hex" Shank Wood Bit

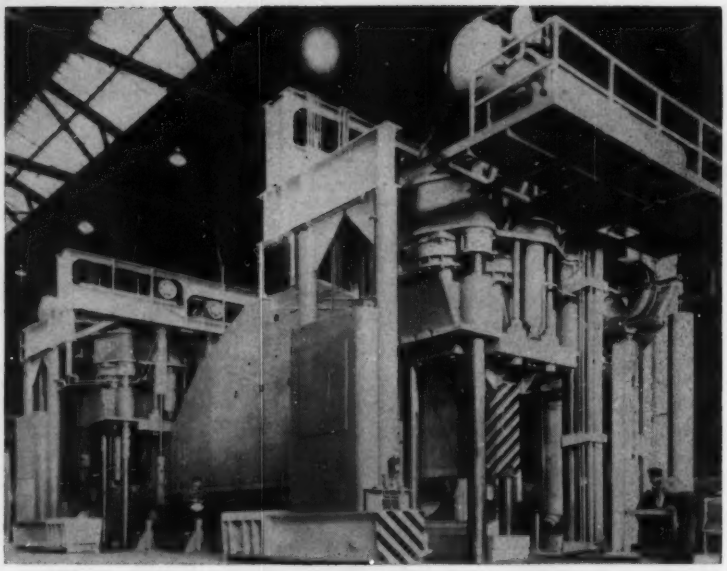


sectional view of 2-Way "Hex" Shank

fits both bit braces and electric drills

Use with hand brace as it comes. Order *without taper square shank,* or use hacksaw to convert to 2-Way "Hex" Shank for use in both hand braces and electric drills. It chucks perfectly—no wobble. Fast boring action speeds work. 2-way usage cuts inventory costs. Longer life cuts replacement costs. Hardened full length. Sizes 4/16 to 17/16". Call your mill supply distributor or hardware wholesaler for complete details.

IRWIN Wilmington, Ohio — HEX SHANK WOOD BITS



Huge Press Bends B&W Boiler Drums

A 50-ton steel plate, measuring 7½-in. thick and 36 ft long, can be bent in this huge Twin Press. Babcock & Wilcox Co recently installed the press at the Barberton, Ohio, Works for bending large boiler drum half shells.

The press has a capacity of 5,000 tons and stands over 25 ft high. It was designed and built by B&W employees.

Promote LBE, O'Brien Urges Manufacturers

Unanimous participation in the new "Live Better . . . Electrically" market-development program was called for by W. V. O'Brien, vice president of General Electric Co's Apparatus Sales Division. He spoke before the National Electrical Manufacturers Association's recent annual winter conference in Chicago.

O'Brien urged all manufacturers of home electrical equipment to adapt their promotional objectives to this common purpose, mobilize their advertising behind the LBE slogan, and thereby double the use of electricity in the American home by 1960.

U. S. Copper Production

Primary copper production in the United States in February totaled 89,491 tons, almost 7,300 tons less than for January, reports the Copper Institute, New York. Refined copper production was 127,917 tons in February, an increase of about 4,200 tons over January production. Deliveries to fabricators amounted to 139,383 tons, or more than 8,950 tons in January. Refined stocks at the end of February amounted to 47,053 tons or almost 3,000 tons lower than the refined copper stocks at the end of January.

Aluminum Production

Primary aluminum production in the United States in February totaled 132,762 tons, according to the Aluminum Association, New York. This amount is 7,636 tons less than the January production, but up 6,526 tons over February 1955.

Total production was 273,106 tons for 1956 through February compared to 244,439 tons for the corresponding two months in 1955. All-time record production figures are: Month —140,748 tons in December 1955; quarter—409,093 tons in fourth quarter 1955.

M&M BRIEFS

Canadian General Electric has opened its new $750,000 office and warehouse in Vancouver to handle distribution of a complete range of electrical consumer products and industrial electrical supplies to all parts of British Columbia. New building has two-acre floor area and special facilities include a modern showroom, auditorium and remote control lighting.

Schwager-Wood Corp, Portland, Ore., has been awarded a $131,750 contract for electrical equipment for fishwater units at The Dalles Dam. The contract, awarded by the Portland District, Corps of Engineers, calls for design, manufacture and delivery of 115 and 230 kv equipment for fishwater units 1 and 2 and main units 1-24 of the powerhouse. Completion date is June 1, 1957.

Borden Co announced recently that its new polyvinyl chloride resin plant will be completed in June. The operation, located on a six-acre tract at Leominster, Mass., will have production capacity of about 12 million lb a year.

Dow Chemical Co recently opened a new $1.1-million laboratory building for research in biochemistry. Its stated objective is helping humanity to a better future. The operation's assignment is to safeguard industrial workers by investigating proposed chemical products; basic research in biochemistry; and specific research for new products.

Seventeen industries making use of atomic energy, together with public safety groups and government agencies, have recently started planning a program on national standards for the commercial and industrial use of fissionable material. Committee chairman is Morehead Patterson, president, American Machine & Foundry Co, New York.

Battelle Institute has established an Electronic Reliability Division for research in design and quality of components and in simplicity of the overall system. The Division will be located at the laboratories at 505 King Ave, Columbus 1, Ohio. K. E. Cochran is chief of the new division.

Before you buy an
Automatic Oscillograph
Look at the Record
Look at the record of Hathaway's engineering know-how, achieved through years of experience in the automatic oscillograph field . . . Then look at the records taken by the new Hathaway RS-9 Fourteen and RS-9 Thirty.
A look at these records proves Hathaway RS-9's are the best automatic oscillograph investment you can make. Hathaway RS-9's give you time-proven performance . . . plus . . . More channels . . . Faster starting . . . More types of starting relays . . . Sharper traces . . . Lower expansion cost.
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Write today for information on the new RS-9's. If you wish, a qualified Hathaway engineer will call to discuss your application.
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EARL D. EDWARDS

THEODORE A. SCHLINK GEORGE W. HATHWAY Q. W. WELLINGTON

Central Illinois Ups 4 Officials

In a series of executive promotions at Central Illinois Light Co, Earl D. Edwards was elected president of the utility, and Theodore A. Schlink, former president, was elected chairman of the board of directors and chief executive officer.

In other changes, George W. Hathway, administrative vice president, was appointed executive vice president, and Q. W. Wellington was elected vice president in charge of electric and gas operations.

Edwards, formerly vice president, has been associated with the company since 1923 when he was employed as chief engineer at the utility's Pekin district. A year later he was transferred to the Central Illinois generating plant in East Peoria in the same capacity. In 1931, after a two-year absence during which he served Commonwealth & Southern System as supervising engineer, he was named operating mechanical engineer for Central Illinois. In 1941 he was appointed electric superintendent. He became vice president in charge of operations in 1951 and was elected a director in 1954. Edwards is also an alternate director of Nuclear Power Group, Inc, atomic power project being developed near Chicago under the leadership of Commonwealth Edison Co and in which Central Illinois is a participant.

Schlink recently completed 50 years of continuous service with the utility and has been a director since 1927. He began his career with Central Illinois as treasurer, and assumed the duties of secretary-treasurer in 1927. He was elected a vice president in 1940 and became the utility's president and general manager in 1951.

Hathway, who in addition to becoming executive vice president will assume responsibility of financial matters, has been with the company since 1932. He has served in numerous operating and administrative capacities since that time, including several years as manager of the DeKalb Division. He was promoted to vice president in 1951.

Wellington, superintendent of power since 1951, has been associated in public utility work since 1927 when he joined Commonwealth Power Corp upon graduation from University of Michigan Engineering School. Since joining Central Illinois in 1936 he has supervised the construction of numerous power facilities. He is also a member of the operating committee of the Nuclear Power Group.

DAVIS BENNING

Benning to Head Missouri P&L

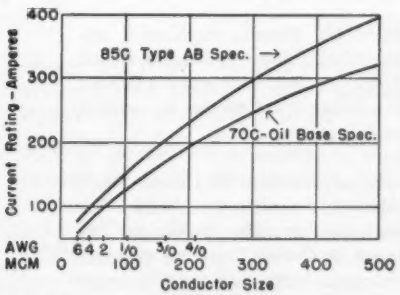
New president of Missouri Power & Light Co is Davis Benning, also president of the Missouri Edison Co. He succeeds F. P. Williams, president since 1953 who retired April 1. Williams is a veteran of 42 years with Missouri P&L and affiliated companies.

Benning, who was also elected a member of the board of directors, attended the University of Missouri and Washington University in St. Louis where he studied law, graduating with an LLB in 1925. After serving nine years as prosecuting attorney of Pike County, La., he became Assistant Attorney General of Missouri and later served two years as City Attorney of Louisiana. He has been Missouri Edison president since 1947 and continues in that capacity.

(*More News About People on page* 156)

Greater current-carrying capacity of Type AB butyl high-voltage cable helps users cut costs, use new or existing facilities more efficiently.

Cable that takes the squeeze out of crowded conduits



85C OPERATING TEMPERATURE rating of Anaconda Type AB cable affords 22% more current-carrying capacity than 70C rated materials, when installed in conduit at 40°C ambient temperature.

Now you can obtain the same amount of current with a smaller cable... or more current with the same size cable—with Anaconda's Type AB butyl high-voltage insulation.

For Anaconda Type AB butyl-insulated cable is recommended for operation at *85C operating temperature.* Industry specifications recommend 70C for oil-base insulations. Thus, as the curves on the chart show, Type AB delivers 22% more current-carrying capacity . . . and more amps per dollar.

New Engineering Bulletin EB-27 gives you full details on performance of Type AB insulation in 15 Industry Specification Tests. Ask the Man from Anaconda for your copy. Or write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

56295 Rev.

SEE THE MAN FROM ANACONDA®

—pioneer in BUTYL INSULATION

CP&L Elevates H. B. Robinson

H. Burton Robinson, vice president of Carolina Power & Light Co's operating and engineering department since 1943 and general manager since 1955, has been assigned additional responsibilities. In his expanded position he will direct activities of three other departments—district operations, headed by Vice President J. C. Richert, Jr; personnel, directed by M. T. Dunlap; and right-of-way, managed by Richard Seawell.

Robinson, also a director of CP&L since 1953, first came to the company in 1925 as a relay engineer. In 1932, after a five-year period with Electric Bond & Share Co, he rejoined the utility, and was named manager of the operating and engineering department six years later.

In other promotions, A. J. Skaale was named manager of the operating and engineering department, and R. S. Talton, production engineer, has been appointed superintendent of power to succeed Skaale.

H. B. ROBINSON

J. ROSECKY

Rosecky Named B-L-H Vice President

Baldwin-Lima-Hamilton Corp has announced the promotion of Joseph Rosecky from manager of manufacturing at the company's Eddystone, Pa., plant to vice president in charge of the heavy industry operations at the Eddystone works.

A 1924 mechanical engineering graduate of the University of Wisconsin, Rosecky has been with B-L-H since 1952. Prior to that he had held various executive positions at Allis-Chalmers Manufacturing Co, A. O. Smith Co, the Heil Co, and Dresser Industries.

PERSONAL BRIEFS

Wisconsin Power & Light Co's new assistant to president **Carl J. Forsberg** is **Earl C. Stolper.** He succeeds **W. D. Baker,** retiring after 37 years with the utility.

Three supervisory changes at Pennsylvania Power & Light Co's Luzerne Division include promotion of **John C. Staudenmeier** to superintendent of residential sales in the division's business development department. **Charles A. Earley,** his predecessor, moves to the company's Scranton Division in the same capacity. Staudenmeier is replaced as assistant to the Wilkes-Barre district manager by **E. Leo Hannye.**

Don Alexander has been advanced from statistician to sales promotion manager by Black Hills Power & Light Co. **Martin J. Westberg,** who formerly handled promotional activities in addition to his other duties, now becomes merchandise sales manager. Filling the newly created post of mechanical engineer is **Joseph Munro,** who will be in charge of construction at the company's Kirk plant.

Daniel J. Torrance, assistant to the president of Puget Sound Power & Light Co for the past 26 years, has retired. Succeeding him is **George R. Rice.**

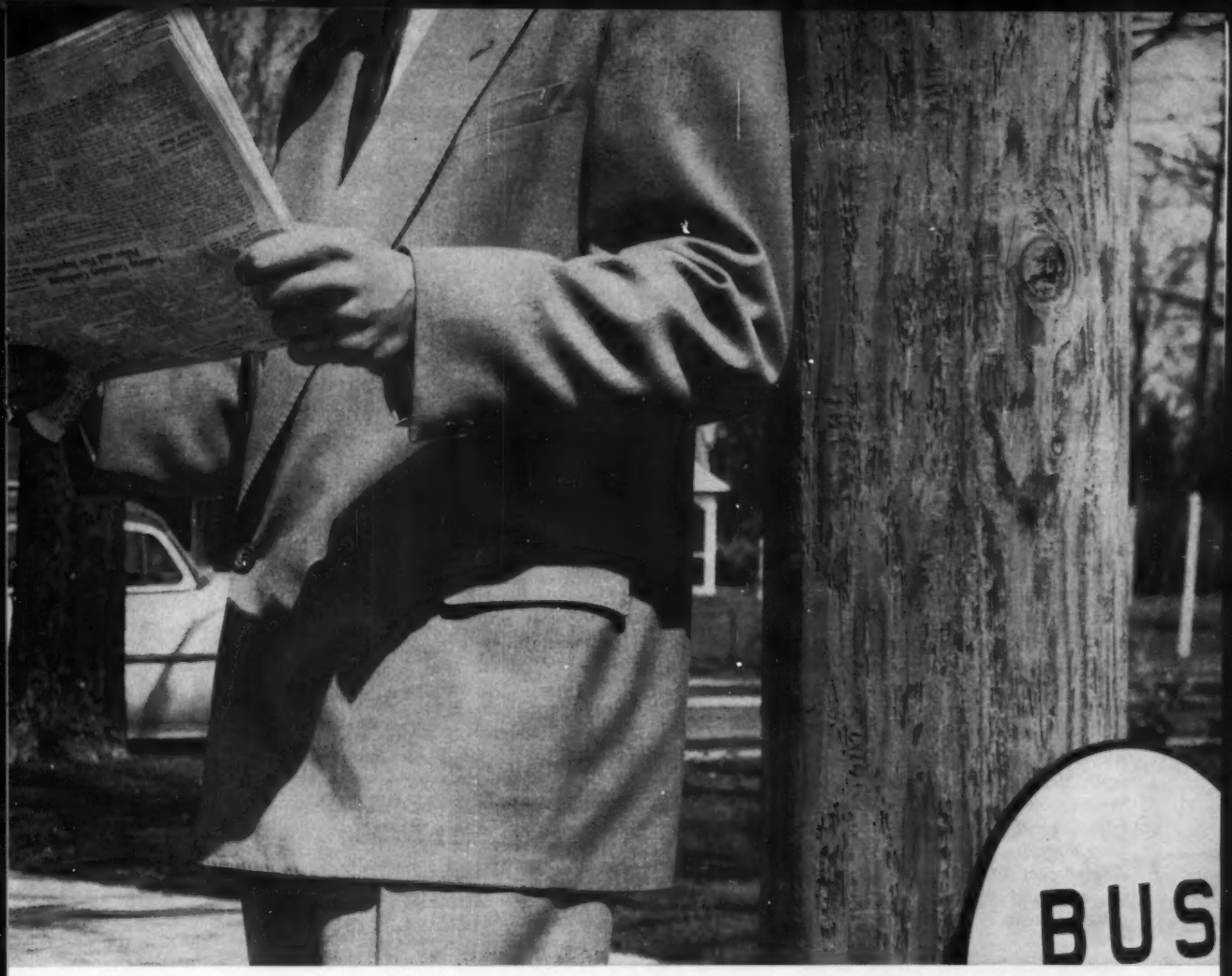
New vice president and assistant general manager of Kennecott Wire & Cable Co is **Walter G. Barney,** former purchasing agent. He will continue to supervise activities of the purchasing department of the Kennecott Copper Corp subsidiary.

Duquesne Light Co has named **Lenard Ilgen,** district engineer, as superintendent of operations, southern district of the transmission and distribution department.

Roscoe G. Marah, mechanical engineer since 1948 for Dayton Power & Light Co, has been named to succeed retiring **Ward Snyder** as assistant purchasing agent.

Recent appointment in United States Rubber Co's electrical wire and cable department include promotion of **Edward T. Corbus, Jr,** from manager of electric utility sales to assistant sales manager of the department, and appointment of **Henry J. Cluver** as manager of the Middle Atlantic Division.

(*Continued on page* 158)



meet your company's top representative

PENTA preserves poles' attractiveness and protects their soundness, too

Hundreds of people meet your poles every day. Hundreds of impressions, good or bad, result. One thing for sure: they'll be *good* if you're using PENTA-treated poles.

PENTA* preservative treatment leaves poles clean and naturally attractive. They meet the strictest civic requirements, and win community appreciation of your system's interest in sound public relations. These strong, protected poles are direct evidence of your interest in sound operations, too. PENTA resists rot and termites years longer. This means less service trouble and expense for you, less inconvenience for your customers. Service records, available on request, verify the outstanding protection you get with PENTA.

Here's why your maintenance people are so "high" on PENTA treatment: this uniform, single-compound preservative gives a running check on pole life expectancy. When you simply measure the amount of PENTA present in the pole at any given time, you're measuring the amount of protection, too.

Yet clean, better-protected PENTA-treated poles cost no more than equipment treated in less completely satisfactory fashion. You'll have no trouble getting them promptly, either . . . over 100 suppliers all around the country treat poles and crossarms protected with effective *PENTAchlorophenol. For more information, please write to THE DOW CHEMICAL COMPANY, Dept. PE980A, Midland, Michigan.

you can depend on DOW CHEMICALS DOW

PERSONAL BRIEFS (*Continued from page* 156)

George White, former executive vice president and director of Vitro Corp of America, has been appointed general manager of General Electric Co's Atomic Power Equipment Department, replacing **Vice Adm Willard A. Kitts, III,** USN (ret). Kitts, acting general manager since June, 1955, becomes manager of a new planning study for the department. White's new responsibilities include management of design, development, manufacture, and marketing of GE commercial atomic power products.

A. C. Meixner has been named to succeed **J. B. Walker** as sales manager of Westinghouse Electric Corp's Transportation and Generator Division. Walker transfers to the company's Pittsburgh headquarters as sales manager of apparatus products. . . . **Russell W. Johnson** has been designated advertising and sales promotion manager of Westinghouse's television-radio division. . . . **Dr. Joseph Slepian,** associate director of Westinghouse Research Laboratories, retired recently after serving the company 40 years. He specialized in the development of high-speed methods of extinguishing arcs in electric power systems.

Western Precipitation Corp's **E. R. Parker** has been appointed chief engineer to head the new Process Equipment Engineering Division . . . New procurement manager for the company is **E. J. Sill,** who will be responsible for purchasing, production, traffic, and other related duties.

William P. Bolger is new manager of I-T-E Circuit Breaker Co's Small Circuit Breaker Division. Bolger, former purchasing agent, replaces **F. G. Schmidt,** recently named manager of Switchgear Division.

Federal Pacific Electric Co has appointed **Paul Hafer,** formerly vice president in charge of engineering for Continental Electric Equipment Co, as superintendent of the Great Lakes regional plant, Cleveland.

Ohio Brass Co has announced the appointment of **E. C. Thompson** as general factory manager in Mansfield, Ohio. He is succeeded as district manager for the Texas territory by **T. J. Harris,** former Chicago district manager. **H. A. Blocki** replaces Harris in the Chicago position.

Recently elected as directors of General Electric Co were **Frederick L. Hovde,** president of Purdue University since 1946, and **Robert T. Stevens,** president of J. P. Stevens & Co and former Secretary of the Army . . . **Clifford B. Woodward, Jr,** former field engineer in the Air Conditioning Division's New Orleans area, is new manager of commercial engineering for GE's Weathertron Department . . . **Robert G. Page** has been named plant manager of the North Hollywood, Calif., plant of GE's Distribution Assemblies Department.

John J. Halvorsen, formerly technical director of plastic pipe and fittings for Continental Can Co, has joined Orangeburg Manufacturing Co, Inc, as manager of sales and development of the company's new plastic pipe division.

National Electrical Manufacturers Association has elected **Michael M. Masterpool,** advertising manager, Portable Appliance Department, General Electric Co, as new chairman of the sales promotion committee.

National Adequate Wiring Bureau's executive committee has appointed **Andrew Doremus,** manager of advertising and sales promotion, sales department, Construction Materials Division of General Electric Co, as chairman of the Bureau's Plan Committee.

OBITUARY

Alexander Macomber, 70, for many years a consulting electrical engineer in Boston, Mass., and a director of electric and gas utilities in various eastern states, died recently. He was a former electrical engineer of Northern California Power Co.

Herman Russell, 77, chairman of the board of Rochester Gas & Electric Corp since 1947, died recently after a long illness. He had served as president of the utility from 1929 to 1947. Employed by the Rochester G & E and its predecessor since 1905, Russell also served as vice president and general manager.

Wins State Apprentice Award

Arizona's outstanding apprentice for 1955 is Everett Babcock, left, relayman for Salt River Power District. In recognition he was awarded a plaque at an Employers' Council meeting in Tucson by John R. Arnhold, right, manager of the Industrial Council in Phoenix and chairman of the selection committee.

The apprenticeship program, inaugurated by Salt River in 1947, is the first in the electrical field in Arizona and one of the first of its type in the nation.

To qualify for the award, Babcock had to fulfill requirements of a program which included 500 hours on a try-out basis with the company and a knowledge of the practical side of the company's operations and also the theory of electricity. He is in his fourth year of apprenticeship under rules of the Arizona Apprenticeship Council.

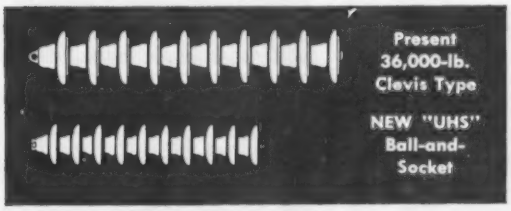
New UHS Ball and Socket Suspension Insulator

Combines close coupling and ultra-high strength with small size—ideal for bundled conductor applications

Never before has such an amazing combination of high mechanical and electrical strength been concentrated in so small an insulator. The unique strength and compactness of "UHS" (Ultra-High Strength) suspension insulators permit economies in transmission line design which should prove most valuable to the utility industry.

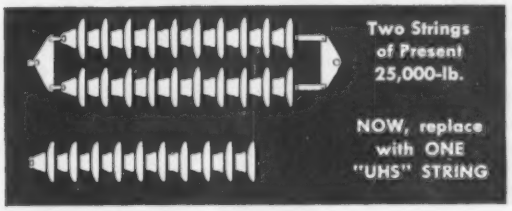
Greater weight-carrying capacity. Shorter strings. Elimination of need for double-string dead-ends. Shorter towers for ultra-high voltage lines. Light weight and simple handling reduce labor costs. All these are now within reach with the new Locke "UHS" insulator.

Look over the facts below. Picture how this development can affect your system. For further details, see our representative nearest you.



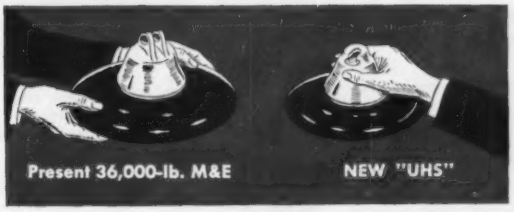
5¾-INCH SPACING

Provides higher flashover per unit string length than present standard 36,000-lb. clevis type insulator, the unit with the nearest comparable strength rating. Even with reduced diameter, effective leakage distance is increased in a given string length.



ULTRA-HIGH M&E IMPACT STRENGTH

In use with bundled conductors, each conductor of the bundle may now be dead-ended on a single "UHS" string. Strength permits use of one "UHS" string to replace two 25,000-lb. strings on dead-end installations, effecting substantial hardware and labor savings. High impact strength and the handling of fewer units minimize breakage loss.



10-INCH DIAMETER, 15½ LBS.

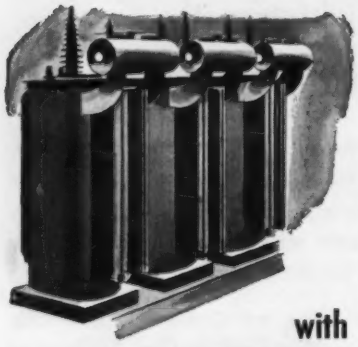
16% smaller and 35% lighter than the A.S.A. Standard 36,000-lb. insulator. Less storage space, more efficient trucking, easier handling.

LOCKE DEPARTMENT
GENERAL ELECTRIC COMPANY
BALTIMORE, MARYLAND

Progress Is Our Most Important Product

LOCKE

Seal oil IN!
Seal moisture OUT!



with

J-M TRANOLSEAL

developed especially for efficient sealing against refined oils

You can stop the dangerous and costly leakage of oil from transformers and switchgear with Johns-Manville's Tranolseal sealing compound. This permanently plastic material has a nondrying vegetable oil base. It provides effective sealing action against air (dust and moisture), inert gas, water, 13% NaCl brine as well as medium to high viscosity refined oils. Thus you can also prevent penetration by moisture and other ambient sources of trouble.

Tranolseal has excellent adhesive qualities and will not corrode or deteriorate metals, rubber or plastics. It shows good resistance to weather and aging (both painted and natural) and won't stain. Furnished in 1" diameter beads. For further information write Johns-Manville, Box 60, New York 16, N. Y. In Canada, Port Credit (Toronto), Ontario.

Johns-Manville
SEALING COMPOUNDS

Coliseum Distribution

(*Continued from page* 85)

limiting busways and current-limiting fuses, in combination with molded-case circuit breakers and other devices, to obtain adequately rated combinations. The ratings were substantiated by test.

Current-limiting fuses are generally used to protect the mains of panelboards containing molded-case circuit breakers. The single set of fuses in the mains limits the I^2t let-through energy to a number of circuit breakers in the panelboard.

Extensive testing of current-limiting fuses and circuit breakers aided the selection of combinations suitable for the Coliseum system. Tests were made not only on the molded-case circuit breakers, but also on panelboards in which they were mounted, motor control centers, busway system components, switches, and associated items.

Extremely high short-current levels in the building demanded current-limiting, silver-sand fuses at the taps from the feeder busways. These range from 30 to 1,200 amp.

Lower Voltages Provided

On each floor a service entrance board taps off power from the feeder busway risers (at short-circuit levels up to 100,000 amp). A 200-amp fused switch, with current-limiting fuses, is the panel's chief protective device. Connections through the utility company's meters to the panelboards containing molded-case circuit breakers have considerable flexibility. The breakers protect circuits to the customers' premises on each floor.

Besides the many 265-v circuits for fluorescent lighting for each customer 120-v circuits are taken from small dry-type transformers. Changes can be made to accommodate customers requiring more or fewer circuits. The high impedance of the small-rating, dry-type transformers eliminates need for current-limiting fuses on the 120/208-v side.

A 480/277-v system has many spots where blocks of power are called for at 120/208 v. For these applications, there are small (Pony) unit substations which normally contain dry-type transformers, perhaps 3 to 5 kva, with the necessary protective and switching devices. In the Coliseum building three 1,500-kva unit Substations (with dry-type transformers) were used to supply the 120/208 load in the exhibition area.

Telemeter
ANY VARIABLE
from Remote Points!

Accurate
HIGH-SPEED
Continuous
for
POWER
PRESSURE
HUMIDITY
POSITION
VOLTS
SPEED, ETC.

Telemeter transmitter converts DC mv from thermal converters, etc. to 10-30 cps which frequency modulates an audio tone channel. Receiver detects and demodulates transmitted signal, generating a DC mv for operation of recorders or indicating instruments. Up to 45 telemeters can be multiplexed. Any communication link, including power line carrier, may be used. Overall accuracy is 1% with a response speed of 1 sec.

Other terminals for teletype, voice-plus-control & data transmission are available.

Write for Technical and Application Data.

Radio Frequency
LABORATORIES, INC.
Boonton, New Jersey, U. S. A.

specify
SHAW-PERKINS
COOLING
RADIATORS

...design standard for the transformer industry

Built by specialists, properly designed throughout to give *any make of transformer* full advantages of economical, dependable thermo-siphon principle of self-cooling. Valves, flanges, elbows, available. Transformer tanks built to customer's design.

Write today for full information.

SP-15

MANUFACTURED BY
SHAW-PERKINS
201 EAST CARSON ST. • PITTSBURGH 19, PA.

Area Development

. . . requires support of power salesmen as field observers for utilities' top management

Utility power salesmen must be detectives as well. They must detect and report to their companies adverse economic and business factors that discourage area development.

Speaking before the Interstate Power Club in New York, George E. Whitwell, vice-president in charge of sales of Philadelphia Electric Co, charged power salesmen with this responsibility.

Company area development committees then can seek ways to correct the situation before industries move away or expand their facilities by building elsewhere, Whitwell said.

Asks Check of Adverse Factors

Most factors adverse to industry are man-made, the utility official observed, and they include unfavorable tax structures, public protest against industry, and a laxity of local law enforcement. These factors are correctable, he declared.

Counteraction should be taken as soon as adverse situations are spotted, especially in areas now being developed vigorously, Whitwell pointed out. But, he added, the responsibility for their correction starts with the power salesman who finds clues to the situation among his industrial contacts.

Economic Study by Utilities Urged

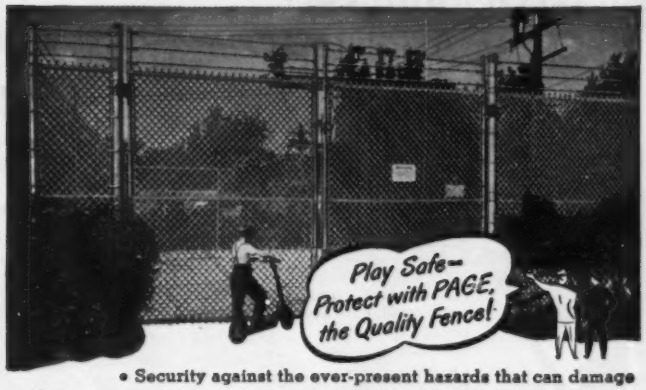
Frank C. Shermer, manager of PE's Market Studies and Service Division, said utilities should investigate all the economic factors involved in the generation and end-uses of power and steam in an industrial plant.

Parallel operation of a customer's power plant with the utility system should be considered by the utility only where the economic study indicates that a reasonable amount of power can be generated by the process heat requirements on a year-'round true-heat balance, Shermer said.

Surveys, he pointed out, frequently show that the load curves of electric and steam demands in a plant are not coincidental. In such instances, Shermer added, no heat balance exists, and large amounts of steam may be wasted to meet the plant's power

(*Continued on page* 162)

PAGE chain link FENCE
America's First Wire Fence—since 1883



• Security against the ever-present hazards that can damage or destroy property, or injure persons, is a responsibility to assign to PAGE Fence. Whether you choose heavily galvanized Copper-Bearing Steel, corrosion-resisting Aluminum, or long-lasting Stainless Steel, PAGE Fence is quality controlled from raw metal to rugged fence erected on metal posts deep-set in concrete. Available are 8 basic styles, varied by heights, types of gates, top rails, and barbed wire strands for added security. Finally, your PAGE Fence will be expertly erected by a reliable, technically trained firm. For important fence data and name of nearest PAGE firm—

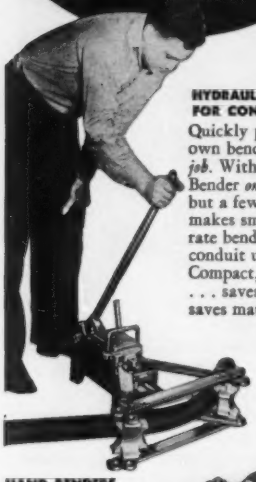
Write to PAGE FENCE ASSOCIATION *in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia or San Francisco.*

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

get your man!

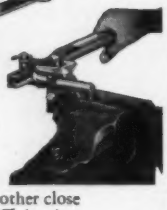
ELECTRICAL WORLD's audience is everyone concerned with generation, transmission, distribution and utilization of electricity in large amounts—25,000 *all-paid* subscribers! In utilities and big industry, among electrical manufacturers and consultants . . . only World covers the entire Electric Power Industry. Like to know more, in easy dosage? Write for "Quick Facts" . . . Electrical World, 330 West 42nd St., New York 36, N. Y.

CUT COSTS WITH GREENLEE TIMESAVING TOOLS FOR ELECTRICIANS



HYDRAULIC BENDERS FOR CONDUIT, PIPE

Quickly produce your own bends *right on the job*. With a GREENLEE Bender *one man* in but a few minutes makes smooth, accurate bends in pipe and conduit up to 5". Compact, portable . . . saves hours, saves materials.



HAND BENDERS FOR TUBING, PIPE, CONDUIT

Quickly form small-radius bends without flattening or kinking. Especially designed to make neat bends for sharp corners, nooks and other close quarters. Saves up to 75% in time and materials on many jobs.

KNOCKOUT PUNCHES AND CUTTERS

For fast, easy enlarging of knockouts and cutting of holes in metal boxes, cabinets, panels. Various sizes and models for making openings for conduit sizes from ½" up to 3½". To operate, simply turn with a wrench.

HYDRAULIC KNOCKOUT PUNCH DRIVER

Portable hydraulic unit for driving GREENLEE Knockout Punches. Speeds jobs . . . easily operated. Develops over 11 tons of pressure so that conduit openings are cut in 10-gauge metal with ease.

CABLE PULLER AND BORING TOOLS

Specifically designed to save time, speed jobs . . . eliminate tedious, heavy work. Companion tools to many other GREENLEE timesavers for the electrician.

GREENLEE

Write for new Electrical Tool Folder, Greenlee Tool Co., 1804 Columbia Ave., Rockford, Ill.

Area Developments

(*Continued from page* 161)

needs. Usually this method of operation is uneconomical compared with the cost of purchased power, and the comparison should be so reported to the customers, the PE executive stated.

The growing importance of automation to industry was described by Clifton A. Walter, editor of GE's Load Magazine. He said automation is the answer to a market that is growing more rapidly than the labor force that will supply it. This means more use of electricity, he declared.

Capt. Theron L. Jenne of the U. S. Air Force opened the day-long program with a discussion of the Air Defense Command.

EEI Unit Plans Study of Supercritical Boilers

The Edison Electric Institute's Prime Movers Committee held its 87th meeting in Philadelphia recently. The 100 members and guests heard that boiler manufacturers are receiving many inquiries on supercritical pressure boilers (there are now five on order) and it appears that the greatest interest is in the 3,500-psig pressure range.

Boiler and combustion subcommittee indicated that it would issue a report on their activities in late March. It would include discussions of pressure fired boilers, outdoor boilers, forced circulation boilers, plastic- vs steel-encased settings, cutting of steam generator tubes by fly ash, superheater and reheater steam temperature control, cyclone fired boilers, soot blowers and boiler cleaning, rate of load pick-up on boilers, and supercritical pressure units.

W. Kenneth Davis of the Atomic Energy Commission said that the need to maintain certain critical data under classification is a problem in the industrial nuclear power program.

Consumers Power Expands

New power plant is planned by Consumers Power Co on Michigan's Saginaw Bay, adjacent to the John C. Weadock Plant, with a first unit of 250,000-kw capacity to be in operation in 1959.

INDIANA STEEL & WIRE CO. MUNCIE, IND. Crapo Galvanizing

Signs along the lines of *Crapo* GALVANIZED STEEL STRAND PERFORMANCE

For dependable performance . . . insist upon *Crapo* Galvanized Steel Strand. Superior tensile strength, combined with long-life, ruggedness and workability, makes *Crapo* Steel Strand first choice for guys, messenger and overhead ground wire.

The famous *Crapo* galvanizing process provides dependable protection for the steel, prolongs the expectant life of the strand.

- Low maintenance cost
- Laboratory tested and controlled quality
- Meets highest quality standards
- A size and grade for all practical needs
- Contact your *Crapo* Jobber Today!

INDIANA STEEL & WIRE CO., INC. Muncie, Indiana

Two New Minerallac Quality Products Designed for Jobs Too Heavy for Standard Jiffy Clips

MINERALLAC Heavy Duty AND Medium JIFFY CLIPS

patent pending

Made of heavier materials! Has exclusive inverted rib, that provides more strength at the bend of clip . . . and, of course, adds the benefits of famous "Snap On" feature!

In stock in Zinc-Plated Steel for Thin Wall or Rigid Conduit up to 6". (Hot Dipped Galvanized may be obtained on order) Can be substituted for malleable clips.

Order From Your Electrical Wholesaler

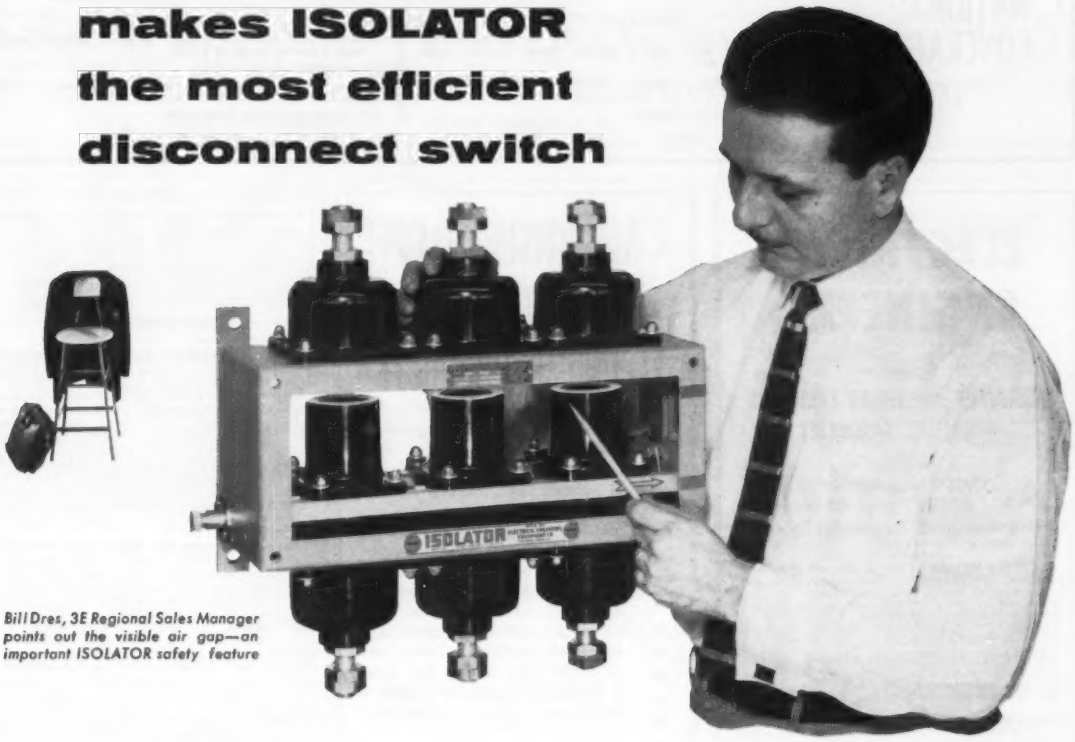
SEND FOR LITERATURE

MINERALLAC ELECTRIC COMPANY

25 North Peoria St. Chicago 7, Ill.

MINERALLAC

Straight line action makes ISOLATOR the most efficient disconnect switch



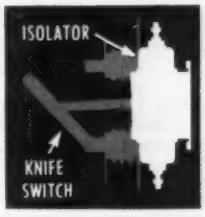
Bill Dres, 3E Regional Sales Manager points out the visible air gap—an important ISOLATOR safety feature

ISOLATORS save on cubicle construction and floor space because they take about ⅓ the space required by equally rated knife switches. They also weigh less and as all elements, including poles, are mounted and aligned on a rigid frame at 3E, they are simple to install.

ISOLATORS are safer ... in the open position, the gap between the bushings is easily visible. Yet the opening is narrow enough to lessen the chance of accidental contact with the live parts. The exposed studs at top and bottom are arranged for easy taping. When your men work in cubicles equipped with ISOLATORS they will be safe from live part hazards.

This switching center, designed and built entirely by 3E, shows how ISOLATORS make a compact, functional and handsome unit. These are, 5 KV, 200 ampere ISOLATORS. The ISOLATOR is also ideal in combination with potheads; any number of arrangements are possible and the units are easily interchanged if necessary. 3E makes many kinds of indoor and outdoor switches, and has a staff of engineers experienced in designing complete units for all types of special applications.

When the ISOLATOR moves from closed to open position its current carrying parts move in a straight line and telescope as contact is made. The parts are enclosed in insulated bushings which also telescope, shielding live parts and eliminating flash barriers.



On your next switching problem, See 3E for recommendations and estimates.
For ISOLATOR data ask for Bulletin 140

ELECTRICAL ENGINEERS EQUIPMENT CO. Melrose Park, Illinois

3E

EMPLOYMENT OPPORTUNITIES

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

Positions Vacant
Positions Wanted
Part Time Work

Civil Service Opportunities
Selling Opportunities Wanted
Selling Opportunities Offered

Employment Agencies
Employment Services
Labor Bureaus

DISPLAYED —RATES— **UNDISPLAYED**

The advertising rate is $19.15 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on a column—3 columns—30 inches to a page.

Subject to Agency Commission.

$1.50 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

Box Numbers—counts as 1 line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Not subject to Agency Commission.

Send NEW ADS to ELECTRICAL WORLD, 330 W. 42nd St., N. Y. 36, N. Y., for April 16th issue closing April 6th.

ELECTRICAL ENGINEERS

SENIOR—
ASSISTANT and JUNIOR ENGINEERS
—COLLEGE GRADUATES

Electrical Design —
Public Utility Power Plants —
Distribution and Transmission Systems

ELECTRIC POWER STATION RELAY & APPLICATION ENGINEER—At least 5 years experience—preparation design and specifications of relay protection for power systems. Also for short circuit, power flow and stability studies. Knowledge of d-c and a-c network analyzer, operation and symmetrical components helpful.

ELECTRICAL ENGINEERS—SENIOR—At least 10 years design experience in steam or hydro plants and transmission substations. Knowledge of operation and construction desirable.

ELECTRICAL ENGINEERS—JUNIOR—Minimum 2 years experience—for electrical design of power stations and substations. Also for general analytical work on relay, short circuit calculations and economic studies.

Location New York—with long established service organization for large group of Utilities. Usual employe benefits. Reply stating age, education, experience, personal particulars and salary expected.

AMERICAN &
FOREIGN POWER COMPANY INC
and SUBSIDIARIES
2 Rector Street, New York 6, New York
21st Floor DI 4-4400 Ext 8494

ENGINEER

Utility management consulting firm with established reputation has opening for qualified electrical engineer who desires attractive position in New York City area where main office is located.

Assignments include the preparation of reports on system planning, economic and efficiency studies, and related utility operating problems. Some field work involved, usually of short duration, to gather information and discuss results with client. Work often involves joint studies with members of firm's other departments who assist clients in all phases of utility operations. Good opportunity to broaden knowledge of utility business and advance to management level.

Experience with operating electric utility necessary.
Salary commensurate with ability and experience.
Write giving education, experience and other qualifications.
Replies will be carefully considered and kept strictly confidential.

P-1216, Electrical World
330 W. 42 St., New York 36, N. Y.

ADVERTISING MAN WANTED FOR TECHNICAL PRODUCTS

Previous advertising experience not necessary but helpful. Must have at least two or three years of college with courses in engineering and technical subjects and like to write. If you have the qualifications we have an opportunity open for you. Man selected will be trained in all phases of industrial advertising. In your letter of application state age, education, positions held, and give statement of why you want a career in advertising. Location: well-known Connecticut company.

P-1205, Electrical World
330 W. 42 St., New York 36, N. Y.

Job Open For

RELAY ENGINEER

with at least four years' experience. Some field experience desirable.

Apply in writing, giving age, education, experience and salary desired, to:

Transmission Dept.
SOUTHWESTERN GAS
and ELECTRIC COMPANY
Shreveport, La.

Your Inquiries to Advertisers Will Have Special Value . . .

—for you—the advertiser—and the publisher, if you mention this publication. Advertisers value highly this evidence of the publication you read. Satisfied advertisers enable the publisher to secure more advertisers and—more advertisers mean more information on more products or better service—more value—to YOU.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1125 W. 6th St. (17)

POSITIONS VACANT

Electrical Engineer opportunity with excellent future for qualified electrical engineer with large Chicago consulting firm. Man between 30 and 45 years of age who has had responsible charge of design and layout of commercial and industrial power, controls and lighting systems. Applicants must be able to direct work and perform contact work with clients. Salary open. Give age and full information as to education, experience, present and past salaries and salary requirements and references. Replies will be acknowledged. P-1119, Electrical World.

Wanted Manager for Municipal Electric and Water Utilities: Basic requirements are: Graduate electrical engineer with practical experience in the engineering, maintenance, administration, and operations of a 4160 volt distribution system serving 5000 customers (no generating plant). Knowledge of and experience with a municipal water supply system is essential. Excellent career opportunity for a high-grade, well-qualified man in a fine suburban community. Interested persons meeting the requirements should apply in writing, stating qualifications, experience, references, age, and other personal history. Address all communications to: R. D. Knapp, Council President 4 Redmond Drive, Madison, New Jersey.

EMPLOYMENT SERVICES

Salaried Personnel, $5,000-$30,000. This Confidential service, established 1920, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited, Jira Thayer Jennings, P. O. Box 674, Manchester, Vermont.

Salaried Positions $5,000 to $35,000. We offer the original personal employment service (established 46 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars. R. W. Bixby, Inc., 558 Brisbane Bldg., Buffalo, N. Y.

POSITIONS WANTED

Power Engineer—Thirteen years experience in plants up to 100,000 K.W. capacity, Technical education, 29 years of age. Seeks responsible position. PW-9387, Electrical World.

Consulting Engrs., Chief Engr., Project Mgr. Reg EE-ME. 22 yrs. industry and railroads, 12 yrs consulting. Power plants, transmission, distribution, industrial. $15,000 N. America, $18,000 Central or So. America. 60 days availability. PW-1156, Electrical World.

SELLING OPPORTUNITY WANTED

Electrical Manufacturers Representatives for Western States calling on distributor, industrial and OEM accounts. Warehouses and offices San Francisco, Los Angeles, Seattle, Salt Lake City. 6 salesmen on road. Desire affiliation with progressive accounts this area. Commission basis only. RA-1238, Electrical World.

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

BUSINESS OPPORTUNITIES — EQUIPMENT - USED or RESALE

UNDISPLAYED RATE:

$1.50 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $1.50 a line an insertion.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:

The advertising rate is $14.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured 7/8 inch vertically on one column, 3 columns—30 inches—to a page.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

SEND NEW ADVERTISEMENTS TO: 330 West 42nd St., N. Y., for April 16th issue closing April 6th

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FOR SALE

Eight Condit Type "08" CIRCUIT BREAKERS

7500 Volt, 400 Amps., 50,000 KVA Rating on a CO-2 min-CO Duty Cycle. Manufactured 1936. In Good Operating Condition. If interested contact N. C. Stirewalt, V.P., Central Illinois Public Service Company, Springfield, Illinois.

MOTORS · GENERATORS
TRANSFORMERS
NEW · REBUILT
WORLD'S LARGEST INVENTORY
ELECTRIC EQUIPMENT CO.
PHONE STATION COLLECT GL 6783
P.O. BOX 51 ROCHESTER 1, NEW YORK

U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-4659) will be received at Denver, Colorado, until April 17, 1956, for furnishing one 2,500-volt, metal-enclosed, indoor-type, motor control equipment assembly for control of four 1,250-hp and four 450-hp synchronous motors; and one 600-volt, metal-enclosed control center assembly for Evergreen Pumping Plant, West Canal Laterals, Block 77, Columbia Basin Project, Washington. Delivery is desired within 270 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer, Commissioner.

IF
there is anything
you want . . .
that other readers
of this paper
can supply
or—
something
you don't want
that other readers
can use,
advertise it here—
in the
SEARCHLIGHT SECTION

TRANSFORMERS

FOR SALE

3—1000 KVA Mol. 11500-2400/4160Y
3— 500 KVA W-H 33000-2300/2400
3— 500 KVA G-E 22000-2300/4000Y
3— 500 KVA GE 13200-2400/4160Y
2— 333 KVA W-H 38000-7200/12470Y
3— 333 KVA A-Ch 13800-240/480
3— 333 KVA G-E 7200/12470Y-2400/4160Y
6— 250 KVA G-E 13800-240/480
3— 250 KVA G-E 2415/2300-600
6— 200 KVA G-E 13200-2400/2300
6— 200 KVA G-E 13200-230/460

Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.
5316 Hetzel St.
Cincinnati 27, Ohio
40 Years' Dependable Service

ELECTRICAL WIRE AND CABLE
—YOUR BEST SOURCE—
• for every industrial and power application
• Odd lengths—long and short—reasonably priced
One of the Largest Stocks in the Midwest
Let us quote on requirements—
send your inquiries
We'll also buy your Surplus
Branch Offices:
Houston— Walnut 3-4580
Los Angeles— ANgeles 3-5148
FOR YOUR TEMPORARY NEEDS TRY OUR SURPLUS DIVISION
UNIVERSAL Wire and Cable Co.
2664M N. Clybourn Ave., Chicago 14, Ill.
EAstgate 7-4777 Code: UNIWIRE

SUBSTATION EQUIPMENT

TRANSFORMERS

QU.	KVA	MFR.	VOLTAGE
3	1000	Mol.	110,000—460
4	2500	Mol.	66000—13800
3	1500	G.E.	66000—2400/4160
3	200	Pitts.	66000—2300
3	1500	Wag.	44000—6900/11950
3	1250	A.C.	44000/11500—460
3	200	West.	44000—480
3	75	West.	44000—7200/12470Y
3	5000	G.E.	38100/66000—6600
4	3333	G.E.	38100/66000Y—33000
4	3125	Mol.	39900/66000Y—26600/46000Y
3	3333	G.E.	33000/11000—2400/7200
1	3000	A.C.	34500—2400/7200/12470 Y, 3 ph.
2	3000	Stand.	33000—4160, 3 ph.
1	2500	A.C.	34500—13800, 3 ph.
1	2000	Kuhl.	33000—6900, 3 ph.
3	667	A.C.	33000—2400/4160 Y
3	200	A.C.	34500—2400/7200/12470Y
3	200	G.E.	34500—120/240
3	75	Wag.	33000—240/480
2	3750	G.E.	26400—4360/2520, 3 ph.
3	400	G.E.	26400—2400
4	1500	A.C.	25400/44000Y—6900/13800
3	333	G.E.	22800/13200—2400
3	100	G.E.	22000—7200/12470 Y
3	50	G.E.	22000—2300
2	3000	G.E.	13800—600, 3 ph. Unit Sub.
3	1200	West.	13800—600, 3 ph. Unit Sub.
1	1000	West.	13200—2300, 3 ph. Unit Sub.
1	600	Stand.	13200—2300, 3 ph.
1	450	Penna.	13200—2400, 3 ph. ASKAREL
3	200	G.E.	13200—2400
3	125	A.C.	6900—2300
3	50	G.E.	4800/2400—240/480
3	333	G.E.	2400/4160Y—460
3	200	West.	2400—240/480
3	150	West.	2400—230/115
3	100	G.E.	2400/4160—120/240
1	100	G.E.	2300—575, 3 ph.
6	50	West.	2400—114/228, Dry Type

ALSO:—FREQUENCY CHANGERS
MOTOR GENERATOR SETS
SYN. CONDENSERS
OIL CIRCUIT BREAKERS
FEEDER REGULATORS, ETC.

BREW, WOLTMAN & CO., INC.
52 Church St. New York 7, N. Y.

LARGE POWER EQUIPMENT
Prompt Stock Shipment
RENUBILT MOTORS - GENERATORS
TRANSFORMERS - CIRCUIT BREAKERS
DO YOU GET OUR STOCK LIST?
BELYEA COMPANY INC.
51 Howell St. Jersey City, N. J.

DIESEL ENGINES — POWER MACHINERY

DIESEL GENERATOR SETS—Stationary—Portable—Mobile
MOTORS and GENERATORS—100 KW to 1500 KW

A. G. SCHOONMAKER COMPANY, INC.
Main Office Box 516, Sausalito, Calif. Sausalito 1600
Branch 50 Church St., N. Y. 7, N. Y. Digby 9-4350

New and Used Equipment Available for
POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION
Send for new list to
EBASCO SERVICES INCORPORATED
APPARATUS EXCHANGE Two Rector St., New York 6, N. Y.

PG&E Makes Movie In Drive to Attract New Industry to Area

The theme that California is the "natural place for industry to grow" runs through a new Pacific Gas & Electric Co sound and color motion picture. It has been produced as a major tool in the utility's program to attract new companies to its service territory.

Aptly named "Golden Horizons," the 30-minute film shows a twentieth century "gold rush," with industry looking to California for a wealth of new markets, labor, technical and scientific skills, transportation, abundant low cost power and fuel, financing, and land for plant sites with space for expansion.

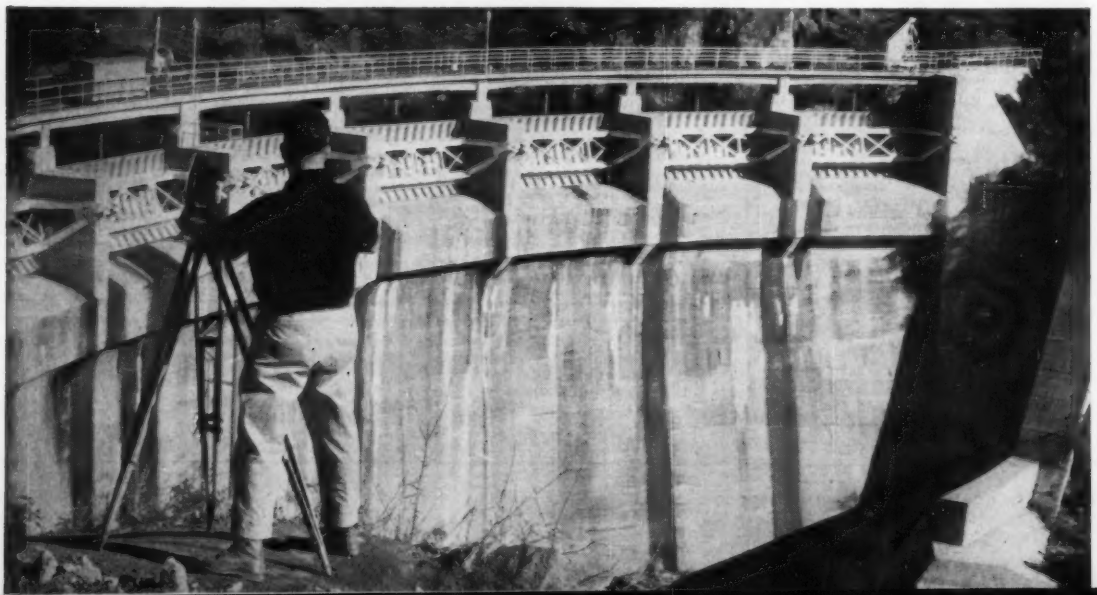
"People" are a key factor in PG&E's campaign to sell California to industry. Because of the state's year-round mild climate and high living standards, people from all over the nation continue to pour into the state. Not only do they create an eager labor force, but huge new markets, the movie points out.

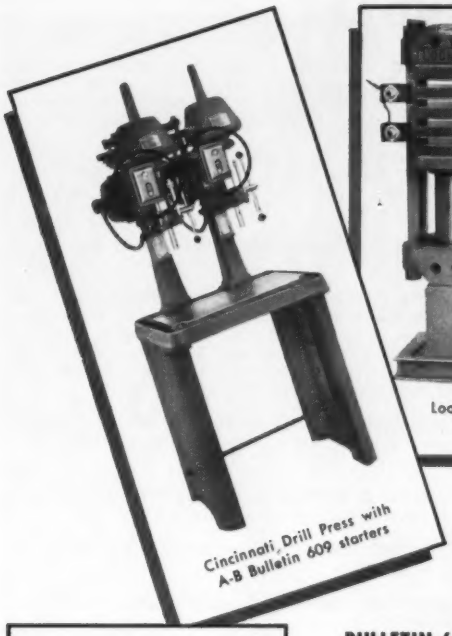
"The film will tell industrialists in other parts of the country about California's new markets," O. R. Doerr, PG&E vice president in charge of sales, declared. "By showing evidence of rapidly growing markets, scenes of new residential communities, excellent transportation and utility systems, and the vast industrial plants already located here, we believe that our invitation to new industry is clear."

The movie, taken entirely between September, 1955, and January, 1956, shows evidence of the state's favorable climate and recreational facilities; its wealth in natural resources; some of PG&E's generating plants; roads, waterways, railroads and airports; and a cross section of its diversified industries, from cement making to the burgeoning electronics plants. The narrator explains the "linkage" between these various industries—how they supply equipment or components for each other, and how this interdependence guarantees stability in the state's economy.

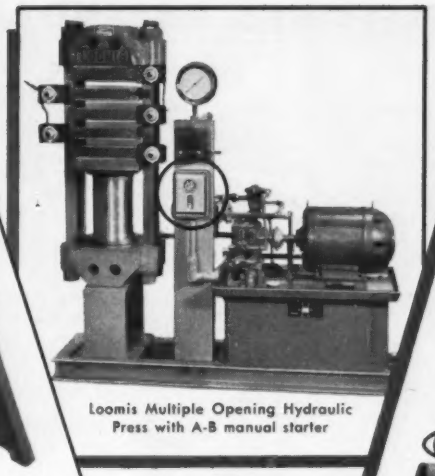
To take scenes for the picture, Cameraman Jon F. Stanton travelled more than 15,000 mi through the company's 46-county area in northern and central California. Production was supervised by the advertising and publicity department.

The film will be available through company offices in PG&E's territory and will be distributed nationally through a commercial distributor for use by business and industrial groups looking for plant sites.

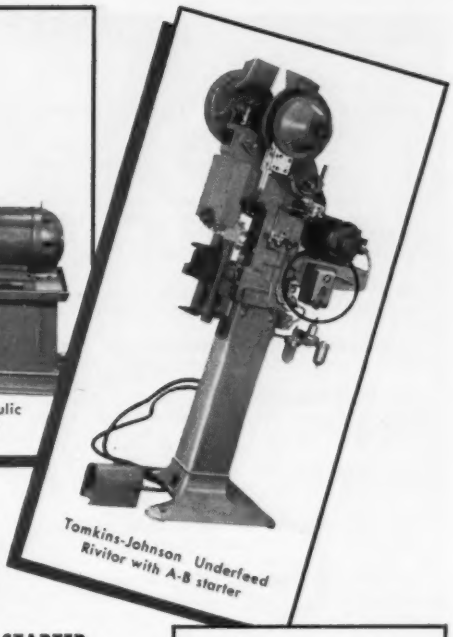




Cincinnati Drill Press with A-B Bulletin 609 starters



Loomis Multiple Opening Hydraulic Press with A-B manual starter



Tomkins-Johnson Underfeed Rivitor with A-B starter

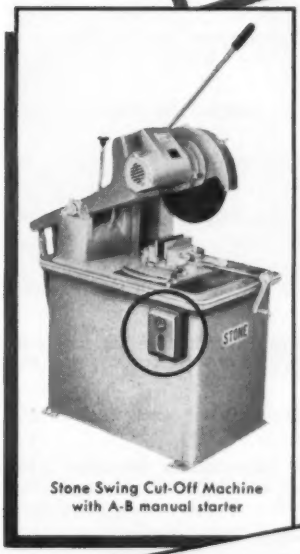
BULLETIN 609 STARTER

THE MOST POPULAR MANUAL MOTOR STARTER with both machinery builders and machinery users

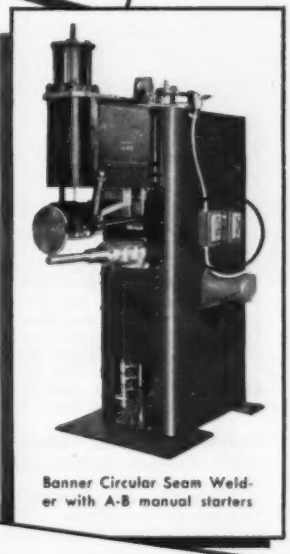
Lots of motorized machines have manual starters . . . but where sudden restarting of the machine, upon return of power after voltage failure, can endanger the operator—an automatic starter should be used. Nevertheless, there are many safe applications for Bulletin 609 manual starters . . . rated up to 5 hp, 220 v; 7½ hp, 440-550 v. Dependable overload protection is provided. Double break, silver alloy contacts require no maintenance.

Allen-Bradley Co.
1327 S. First St.
Milwaukee 4, Wis.

In Canada—
Allen-Bradley Canada Ltd.
Galt, Ont.



Stone Swing Cut-Off Machine with A-B manual starter



Banner Circular Seam Welder with A-B manual starters

ALLEN-BRADLEY

A-B Quality

MOTOR CONTROL

Timesaver Speedmoulder with two A-B manual motor starters

Mook Single Spindle Shaper with A-B Bulletin 609 starter

MEETINGS CALENDAR

APRIL

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—South West District Meeting, Baker Hotel, Dallas, Tex., April 2-4; Special Technical Conference & Exhibit on Magnetic Amplifiers, sponsored jointly with the Institute of Radio Engineers and the Instrument Society of America, Hotel Syracuse, Syracuse, N. Y., April 5-6; 8th Conference on Electrical Engineering in the Rubber and Plastics Industries, Mayflower Hotel, Akron, Ohio, April 9-10; Great Lakes District, Fort Wayne, Ind., April 16-18; Technical Conference, Bradford Hotel, Boston, Mass., April 26-27.

INDIANA ELECTRIC ASSOCIATION—16th Annual Young Men's Utility Conference, Hotel Van Orman, Fort Wayne, Ind., April 4-5.

* **AMERICAN SOCIETY OF LUBRICATION ENGINEERS**—11th Annual Meeting and Exhibit, Hotel Wm. Penn, Pittsburgh, Pa., April 4-6.

ELECTRICAL MAINTENANCE ENGINEERS ASSOCIATION—8th National Biennial Electric Industry Show, Shrine Exposition Hall, Los Angeles, Calif., April 5-7.

MARYLAND UTILITIES ASSOCIATION—Annual Business Conference, Lord Baltimore Hotel, Baltimore, Md., April 6.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Machine Design Conference, Bancroft Hotel, Worcester, Mass., April 10-11.

MIDWEST RESEARCH INSTITUTE—Symposium for Management on Applications of Analog Computers, Hotel Phillips, Kansas City, Mo., April 10-11.

POINT OF PURCHASE ADVERTISING INSTITUTE—10th Annual Symposium & Exhibit, Hotel Sheraton Astor, N. Y., April 10-12.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—Engineering & Operation Section, Hotel Vancouver, Vancouver, B. C., April 11-13.

NORTHWEST PUBLIC POWER ASSOCIATION, INC—Annual Membership Meeting, Ridpath Hotel, Spokane, Washington, April 11-13.

SOUTHEASTERN ELECTRIC EXCHANGE—Engineering & Operation Section, Bon Air Hotel, Augusta, Ga., April 12-13.

EDISON ELECTRIC INSTITUTE—Advisory and Executive Committees, Hotel Commodore, New York, N. Y., April 16; National Conference of Electric & Gas Utility Accountants, sponsored jointly with AGA, Hotel Commodore, April 16-18; Industrial Relations Committee, EEI Headquarters, N. Y. C., April 19; Engineering Committees, Edgewater Beach Hotel, Chicago, April 30-May 2.

GREATER NEW YORK SAFETY COUNCIL—26th Annual Safety Convention & Exposition, Hotel Statler, New York City, April 16-20.

ATOMIC INDUSTRIAL FORUM, INC—Atomic Energy Conference, Atlantic-Biltmore Hotel, Atlanta, Ga., & Oak Ridge, April 17-18.

BITUMINOUS COAL RESEARCH, INC—Annual Meeting and 3rd Techno-Sales Conference, Deshler Hilton Hotel, Columbus, Ohio, April 18-19.

PACIFIC COAST ELECTRICAL ASSOCIATION—Administrative Services Section Meeting, Huntington-Sheraton Hotel, Pasadena, Calif., April 18-20.

MISSOURI VALLEY ELECTRIC ASSOCIATION—Engineering Conference, Hotel President, Kansas City, Mo., April 18-20.

PENNSYLVANIA ELECTRIC ASSOCIATION—Meter Committee, Roosevelt Hotel, Pittsburgh, Pa., April 19-20.

PROTECTIVE RELAY ENGINEERS—Ninth Annual Conference, Department of Electrical Engineering, Agriculture and Mechanical College of Texas, College Station, April 23-25.

VIRGINIA POLYTECHNIC INSTITUTE—Seventh Annual Engineering Conference, Blacksburg, Va., April 26-28.

ROCKY MOUNTAIN ELECTRICAL LEAGUE—Spring Meeting, Shirley-Savoy Hotel, Denver, Colo., April 29-May 1.

MAY

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—North Eastern District Meeting, Rochester, New York, May 2-4.

EDISON ELECTRIC INSTITUTE—Accident Prevention Committee, Coronado Hotel, St. Louis, Mo., May 2-4; Purchasing & Stores Committee, Sheraton Plaza Hotel, Boston, Mass., May 7-9; Commercial Electric Cooking Conference, Sheraton Hotel, Chicago, Ill., May 8; Transportation Committee Meeting, jointly with AGA, Congress Hotel, Chicago, Ill., May 8-11; Industrial Relations Committee, Willis E. Hughes Memorial, Rochester, N. Y., May 17; Orientation Meeting, jointly with AGA, Headquarters, New York, N. Y., May 21.

NATIONAL FARM ELECTRIFICATION CONFERENCE—LaSalle Hotel, Chicago, Ill., May 3-4.

* **PENNSYLVANIA ELECTRIC ASSOCIATION**—Hydraulic Power Committee, Hotel Warwick, Philadelphia, Pa., May 3-4; Transmission and Distribution Committee, Skytop Lodge, Skytop, Pa., May 10-11; Relay and Electrical Equipment Committees, Hotel Roosevelt, Pittsburgh, May 17-18; Systems Operations Committee, Bedford Springs Hotel, Bedford, Pa., May 24-25.

NATIONAL ASSOCIATION OF RAILROAD AND UTILITIES COMMISSIONERS—Executive Committee, Leamington Hotel, Minneapolis, Minn., May. 4,

AIR-CONDITIONING & REFRIGERATION INSTITUTE—Annual Meeting, The Homestead, Hot Springs, Va., May 7-9.

AMERICAN WELDING SOCIETY—Fourth Welding Show, Memorial Auditorium, Buffalo, N. Y., May 9-11.

ATOMIC INDUSTRIAL FORUM, INC—Hotel Plaza, San Antonio, Texas, May 10-11.

NORTHWEST PUBLIC POWER ASSOCIATION, INC—Engineering & Operations Section, Cascadian Hotel, Wenatchee, Washington, May 10-11.

PUBLIC UTILITIES ADVERTISING ASSOCIATION—Annual Convention, Philadelphia, Pa., May 10-11.

INTERSTATE POWER CLUB—Hotel Martinique, New York City, May 14.

PACIFIC COAST ELECTRICAL ASSOCIATION—Annual Convention, Las Vegas, Nevada, May 14-16.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Design Engineers—Design Engineering Conference, Convention Hall, Philadelphia, Pa., May 14-17.

ILLINOIS INSTITUTE OF TECHNOLOGY—Industrial Nuclear Technology Conference, Museum of Science & Industry, Chicago, Ill., May 15-16.

GREAT LAKES POWER CLUB—Wagon Wheel Hotel, Rockton, Ill., May 17-18.

NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS—30th Engineering Industries Exposition with Annual Convention, Statler Hotel, New York City, May 17-19.

INDUSTRIAL HEATING EQUIPMENT ASSOCIATION, INC—Spring Meeting, The Homestead, Hot Springs, Va., May 20-23.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—Business Developments Section, Benjamin Franklin Hotel, Seattle, Wash., May 21-23.

AMERICAN MANAGEMENT ASSOCIATION—General Management Conference, Hotel Roosevelt, New York City, May 23-25.

NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS—Annual Meeting, Ambassador Hotel, Atlantic City, N. J., May 23-26.

CIGRE—16th Annual International Conference, Paris, France, May 30-June 9.

JUNE

EDISON ELECTRIC INSTITUTE—24th Annual Convention, Traymore Hotel, Atlantic City, June 4-6.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Summer and Pacific General Meetings, San Francisco, California, June 25-29.

* Additions this week.

This could be you—"In the Land of No Distributors."

Consider your plight if there were no distributors!

Instead of making out *one* order (to your distributor) covering your need for a variety of products—you would have to make out *many* orders—one for the wire, one for the boxes, another for the connectors and so on—and on—and on! When the bills came in from the various manufacturers it would be the same old story—separate checks, separate bookkeeping entrees, separate letters, separate headaches.

In addition, "In the Land of No Distributors"—

- **You would go "telephone crazy" placing hundreds of calls a day to a variety of different manufacturers located miles away.**
- **You would be pestered by an army of manufacturers' salesmen.**
- **You would take the chance of getting only partial delivery—and waiting days for important equipment from "slow" manufacturers.**
- **Your "over-the-counter" purchases would be major endeavors.**
- **You would be forced to carry a tremendous inventory—and insure it.**

That's why dependable electrical manufacturers advise you to always buy from

YOUR DISTRIBUTOR—THE BEST FRIEND YOUR BUSINESS CAN HAVE! He's the *one* source for *everything* electrical—and he's local.

It Must Be Right
The Trade Mark of TOP Quality
TRIANGLE

TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, NEW JERSEY

Manufacturers of Arteries for Electricity, Liquids and Gases

WIRE • CABLE • CONDUIT • BRASS and COPPER TUBE • PLASTIC PIPE

Kansas City P&L Wins Outdoor Poster Campaign Award

The outdoor poster shown above is from the entry of Kansas City Power & Light Co which received the first award in the Poster Campaign Division of the Fourth Annual Local Outdoor Advertising Contest.

A record number of more than 300 entries was received this year in the nation-wide contest which was established in 1952 as an annual event by the Outdoor Advertising Association of America, Inc, to give recognition to local advertisers who make exceptionally good use of the medium.

Thirty local advertisers who made outstanding use of outdoor advertising during 1955 were selected for first, second, or third awards in ten contest divisions. Sharing in the awards are the advertisers' agencies, the artists, and the local outdoor advertising companies.

Besides KCP&L, awards went to the advertising agency, Potts-Woodbury, Inc, to the artist, Fred Haslam of KCP&L, and to General Outdoor Advertising Co, Inc, of Kansas City.

AREA DEVELOPMENT BRIEFS

J. B. Thomas, president, Texas Electric Service Co has initiated research that has led to the proposal of a revolutionary and far-reaching plan for a "Greater Fort Worth Tomorrow."

The plan is aimed at preventing metropolitan Fort Worth from strangling in its own traffic by 1970; assuring Fort Worth's continued growth and prosperity.

A traffic-free central business area would have battery-powered shuttle cars, underground freight and delivery services, and loop highways.

Virginia electric utilities and West Virginia University have carried out joint research into commuting patterns of industrial workers in a number of West Virginia cities and towns. Purpose of study was to provide information on actual size of area from which a new industrial plant may draw its workers.

Southern Co and its affiliates are participating in a national advertising campaign to draw attention to the business opportunities in the area. In addition to ads in local newspapers in each company's area, national ads are being placed in Time, Business Week, U. S. News & World Report, and the Wall Street Journal.

West Penn Power Co is sending out clever direct mailing piece called "doodle letter", pointing out that West Penn is always ready to assist industry with plant location studies in its area. Letter is cleverly illustrated with doodles designed to attract readership.

Another clever mailing piece comes from Cincinnati Gas & Electric Co which is using a blotter to which is stapled a jotting, or note pad. Blotter publicizes new industries which have located in Cincinnati, or local industries which have expanded.

Wisconsin PS Awards Employees for Good PR

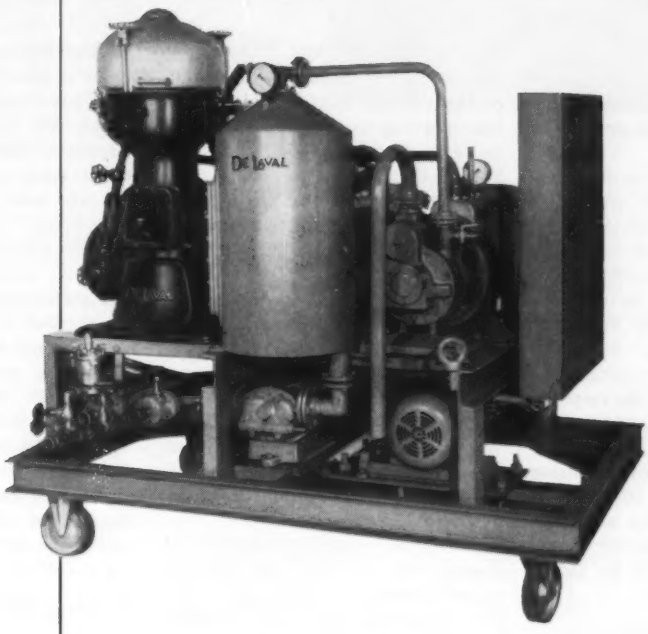
Employees of Wisconsin Public Service Corp who have contributed the most to the improvement of public relations through exceptional service and courtesy to customers, were honored at a recent meeting of company officials.

For the first time since the annual competition was started in 1952, the contest ended in a tie between two candidates with outstanding records. As a result, Miss Jean Ovitz, Rhinelander home economist, and Wilfred Gries, local representative, Brillion, each received the C. R. Phenicie Public Relations Award trophy, a $50 savings bond and $100 in cash from Pres Harold P. Taylor. Third place winner was Carl Huettl, Wabeno salesman, who received a Certificate of Merit and a $50 bond. Six other employees received Certificates of Merit.

The award, established in Feb. 1952, is named after C. R. Phenicie, retired Public Service executive.

NOW...

ASSURED DIELECTRIC STRENGTH OF 40 KV!



Maintenance of ultra-high dielectric strength in transformer oil is no problem with the De Laval High Vacuum Method. New oil can easily attain *40 kv* . . . and retain this high strength for long periods.

This exclusive De Laval Method is entirely new. It combines centrifugal purification with highly efficient *vacuum drying*. Oil is first heated . . . then centrifuged and dispersed into the purifier cover where a vacuum of over 90% is maintained. *Both free and dissolved moisture are continuously removed.*

The high degree of vacuum separation also results in complete removal of air or other gases in the oil, while treatment under vacuum throughout prevents it from dissolving further gases and from oxidizing.

For complete information on this newest . . . most efficient and economical method of insulating oil maintenance . . . write today!

DE LAVAL
insulating oil purifiers

THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • DE LAVAL PACIFIC CO. 201 E. Millbrae Ave., Millbrae, Calif.

Lynn G&E Gets 4% Rate Increase

- **Company's petition notes serious affect of 1954 hurricane**
- **Massachusetts DPU says increase will bring return to 5.75%**
- **Notes 1953 order found 6.19% return would be reasonable**

The Massachusetts Department of Public Utilities has granted Lynn Gas & Electric Co an increase of approximately 4% in rates. The order was dated Feb. 6.

The order, after outlining the financial structure and the company's service area, noted: "The proposed increases in rates affect only the respondent's electric department. In 1953 respondent showed an operating income before interest as the result of its sale of electricity of $744,134. In the year 1954 the comparable figure was $619,398. **However, the respondent's operations during 1954 were seriously affected by the hurricane of September 1954, and after normalizing the results to exclude the effect of this non-recurring expense, the net operating income for this period in the electric department would be $675,923.** (Emphasis supplied.)

Revenues Increased 4%

"The results for the 12 months period ending Sept. 30, 1955, show a comparable figure of only $616,232, indicating a decrease in net revenues of some $59,691 as between the two periods. **As between the year 1953 and the 12 months ending Sept. 30, 1955, respondent's total electric operating revenue increased by a modest 4% from $5,421,173 to $5,643,964.** (Emphasis supplied.)

"As between the same two periods, however, its total operating expenses increased from $4,042,322 to $4,543,211 or about 11%. Of this increase in expense, $362,653 represents an increase in operating expenses and $100,251, an increase in taxes other than franchise and income taxes. The increase in operating expenses is distributed over all categories of expense except production expense which shows a slight decline.

"The current position of the company is perhaps best illustrated by a comparison of its income statement for the nine months ending Sept. 30, 1954, with a similar period in 1955. For this period in 1954, it showed an income before interest of $451,695, or about $500,000 after adjusting for non-recurring expenses, as against a figure for the same period in 1955 of $436,254, although its comparative gross revenues in the same period showed a fairly substantial increase."

Rate Base: $12,448,096

The order continued: "Using as a test period the 12 months ending Dec. 31, 1955, respondent shows an average net plant (estimated in part) plus materials and supplies used in the electric department of $12,448,096. We will adopt this figure as a proper rate base for use in these proceedings in considering the propriety of the proposed increases in rates.

"It will be noted that this figure includes only the physical property actually devoted to public service and that respondent has made **no claim for any of the modifications of the rate base which have been advanced from time to time by this and other utilities.** (Emphasis seemingly refers to a fair value rate base claim.) On the basis of its first nine months' results, respondent estimates that it will realize a net operating income before interest in the electric department for the year 1955 of $619,864, representing a return on the rate base so found of 4.98%."

Return of 5.33% in 1955

The order noted further "Although it is not pertinent to the present inquiry, it may be noted that the gas department during the same period is estimated to show a net income of $362,571, representing a rate of return on the average net plant plus materials and supplies in this division of **respondent's activities of 6.12%.** (Emphasis supplied.)

"The total company figures, also estimated in part, for the year 1955, indicate an overall **return of 5.33%** (emphasis supplied) on an average plant investment of $18,502,936.

"The proposed increased rates include a modification of respondent's domestic electric rate Schedule A, which will result in increasing the customers' bills to all domestic customers using over 50 kwhr per month, i.e., who have a monthly bill of more than $2.90.

"For customers using up to 150 kwhr, the increase will amount to 10¢ per month on a maximum bill of $6.00. For 85% of the customers, the proposed increase amounts to 35¢ or less per month. **The average customer, who uses 127 kilowatts per month will find his bill increased from $5.11 to $5.21.** (Emphasis supplied.) The new general demand rate Schedule C includes an increase in all steps of the demand charge above 5 kilowatts and in the energy charge for all steps above 600 kwhr.

Earnings Gain $209,967

"The resulting charges compare favorably with those assessed by other electric companies operating in the same general area. The respondent estimates that these proposals will increase its gross revenue from domestic customers by a total of $100,967 a year and from its industrial and commercial customers under Schedule C by a total of $109,000, or a total increase in gross annual revenues of $209,967.

"These estimates are based on 1954 results, but are substantially accurate for use in connection with the rate base we have found. If the proposed rates had been in effect during the 12 months of 1955, the net operating income before interest would have been $715,689, representing a net return on the estimated average plant in service during the period of 5.75%.

"In the last rate case involving respondent (D.P.U. 10056 and 10057) in its order dated Feb. 24, 1953, the Department found **that a return to the company of as much as 6.19% on its rate base would be reasonable.** (Emphasis supplied.) In the present

case, it was testified that the composite cost to respondent of debt and equity capital would be 6.39% at the present time. Any possible modifications which we might make in the figures presented in this testimony would not bring the indicated cost of money below that which we found to be reasonable in 1953.

"Since the rate of return on the company's net investment after the proposed increase is lower than that which we previously found and now find to be a reasonable rate of return, it is apparent, unless the proposed rates are otherwise inequitable, that it is our duty to approve them."

FINANCIAL BRIEFS

San Diego Gas & Electric Co will pay April 16 a quarterly common stock dividend of 22¢ a share as compared with 20¢ a share in the previous quarter.

Merrill Lynch, Pierce, Fenner & Beane has sold quickly a secondary offering of 100,000 shares of common stock of Commonwealth Edison Co at $43.75 a share.

Rochester Gas & Electric Corp is planning to split its common stock on a 3-for-2 basis.

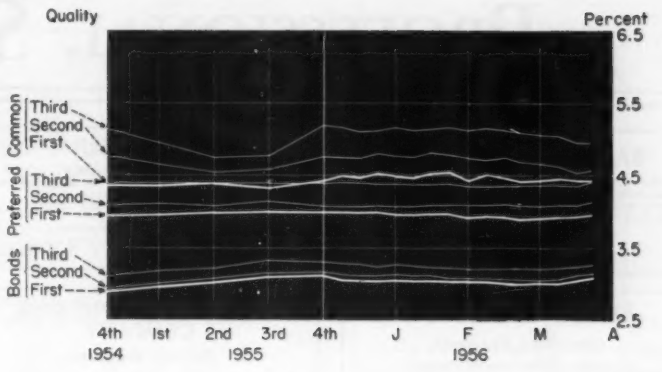
Jacksonville, Fla., City Commission is planning to sell $14 million revenue certificate issue to help pay a $22.5 million expansion program of the Department of Electric & Water Utilities. The other $8 million will be sold in about a year, but not later than March, 1957.

Indianapolis Power & Light Co has asked the Indiana Public Service Commission approval to sell $10 million in first mortgage bonds for expansion of facilities.

Virginia Electric & Power Co has been selected for the second straight year to get from United Shareholders of America, Inc, its Annual Meeting Award for "meritorious achievement" in the field of management-shareholder relationship.

Louisiana Power & Light Co is planning to transfer all its gas and water properties to its subsidiary, Louisiana Gas Service Corp.

Today's Utility Yields (%)



	BONDS			PREFERRED STOCKS			COMMON STOCKS		
QUALITY.....	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Mar. 22.....	3.09	3.14	3.27	3.96	4.13	4.41	4.43	4.57	4.95
Mar. 15.....	3.06	3.11	3.23	3.95	4.10	4.38	4.43	4.52	4.95

Utility Earnings

COMPANY	PERIOD MONTHS ENDED		NET INCOME 1956	NET INCOME 1955	EARNINGS PER COMMON SHARE 1956	EARNINGS PER COMMON SHARE 1955
Carolina Power & Light.....	12	Feb.	$9,561,792	$8,124,523	$1.65(a)	$1.69(a)
Central Illinois Light.....	12	Feb.	4,453,061	3,575,737	3.95	3.07
Central Maine Power.....	12	Feb.	6,590,294	6,217,307	1.72	1.62
Central Vermont Public Service	12	Feb.	1,359,301	1,421,000	1.24	1.32
Houston Lighting & Power.....	12	Feb.	15,560,624	13,105,308	2.60(a)	2.18(a)
Montana Power.....	12	Feb.	8,788,250	7,553,057	3.05	2.58
New York State Electric & Gas.	12	Feb.	10,960,355	9,448,304	2.81(a)	2.59(a)
Oklahoma Gas & Electric.....	12	Feb.	8,520,916	7,241,397	2.39(a)	2.28(a)
Southern Co, consolidated.....	12	Feb.	26,937,580	23,321,251	1.37(a)	1.29(a)

Note—(a) Based on shares outstanding at end of each period.

Utility Financing

COMPANY AND DESCRIPTION	Amount of OFFERING (000)	OFFERING PRICE	YIELD TO PUBLIC
MARCH 22–28			
BONDS			
Narragansett Electric—1st mtg 3½% due 1986.....	$10,000	102.44%	3.37%
SCHEDULE FOR MARCH—APRIL			
BONDS			BID DATE
Georgia Power—1st mtg due 1986.....	$12,000	.....	Mar. 29
Florida Power & Light—1st mtg due 1986.....	15,000	.....	April 3
Columbus & Southern Ohio Electric—1st mtg due 1986	12,000	.....	April 3
Duquesne Light—1st mtg due 1986.....	20,000	.....	April 4
Kentucky Utilities—1st mtg due 1986.....	10,000	.....	April 10
Southern California Edison—1st mtg due 1981.....	40,000	.....	April 17
PREFERRED STOCK			
Kansas City Power & Light—120,000 sh $100 par.....	$12,000	.....	April 10 (a)
Long Island Lighting—120,000 sh.....	12,000	.....	April 26 (a)
COMMON STOCK			
Central Illinois Light—100,000 sh (to be offered commonholders on 1-for-10 basis, record April 3 to expire April 19).....	.....	.....	.....
El Paso Electric—56,025 sh (to be offered commonholders on 1-for-15 basis, record April 4 to expire April 25).....	.....	.....	.....

Note—(a) First Boston Corp group, underwriters.

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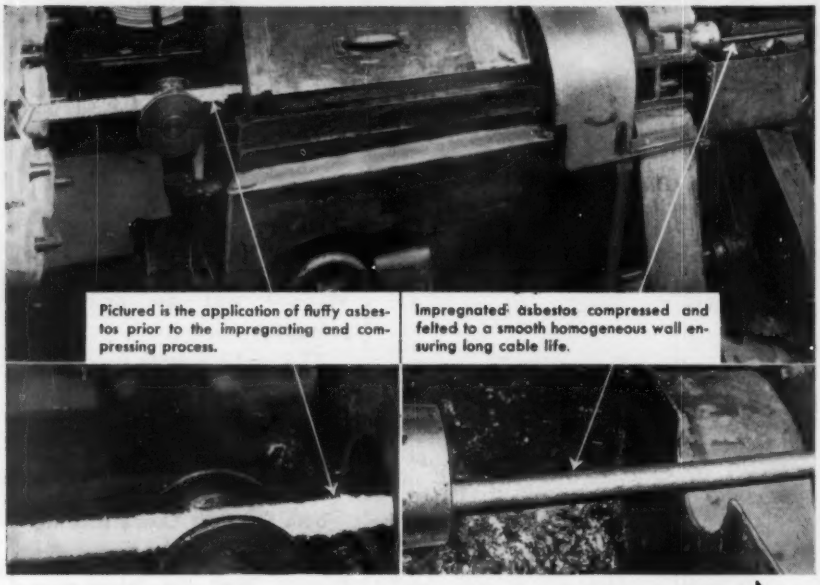

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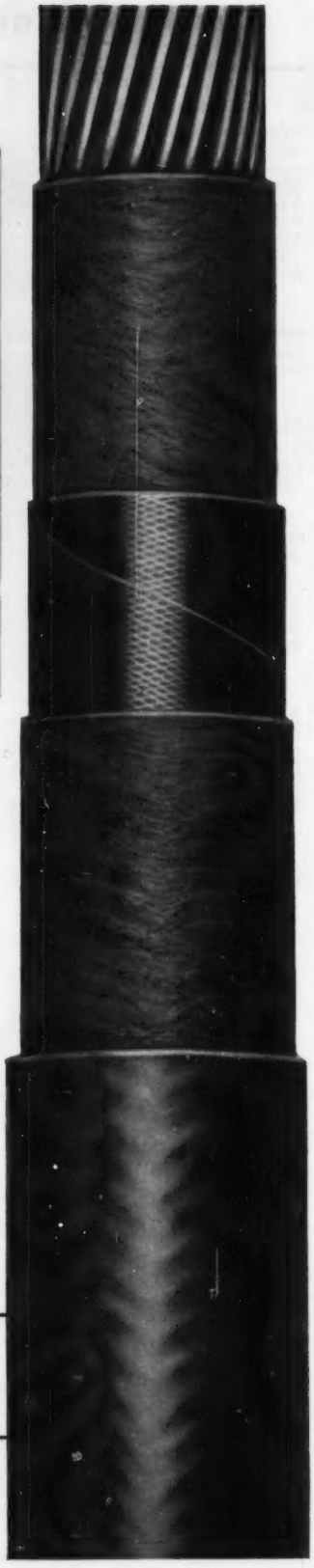

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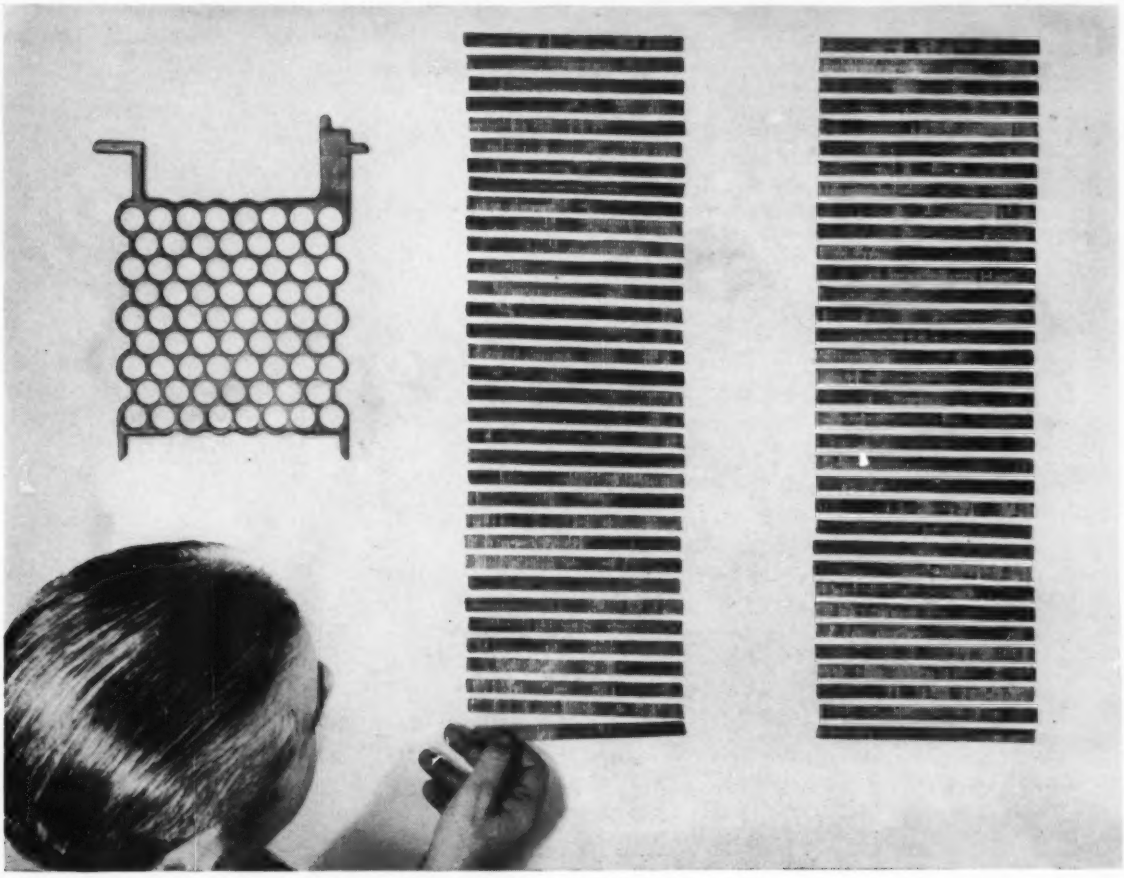
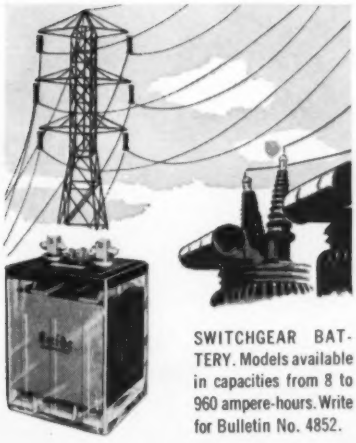


Actual photo of the unwound 68 spiral buttons from just one Exide-Manchex positive plate.

Enormous plate area multiplies battery life



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